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ABSTRACT

This final report describes the plan developed by the Northern Illinois Learning Resources Cooperative, a consortium of 44 community colleges and other academic institutions, which was awarded a Library Services and Construction Act (LSCA) Title III planning grant to research the requirements for a statewide electronic network that would provide for the transmission of high-quality voice, data, and video signals among public, academic, school, and special libraries. The consortium was also charged with recommending the most cost-effective and efficient way to implement such a network. The report covers the following topics: (1) the purposes of the grant; (2) the methodology and goals of the study; (3) the process and results (concerns and services) of a needs assessment; (4) the current library and education telecommunications environment (voice, data, video, and integrated networks in the state) and selected statewide or integrated networks outside the state; (5) trends in library services and telecommunications technology; and (6) functional design criteria, including the purpose and functions of a state library telecommunications network, functional design requirements, and network strategies. Alternatives for meeting telecommunications needs for the next 5-10 years are also presented, together with recommendations for the development of a library telecommunications network, a management action plan for implementing the recommendations, and projected target dates. Additional information about the study is appended (including maps and descriptions of several proposed or actual networks) and a glossary is provided. (53 references) (CGD)

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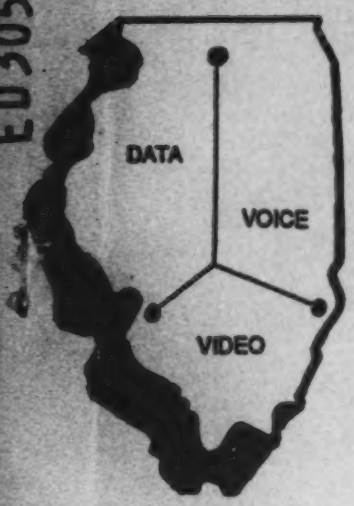


# A Functional Plan For an Illinois Library Telecommunications Network

August 1988

JIM EDGAR
Secretary of State
and State Librarian

Bridget L. Lamont
Director
Illinois State Library

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# A FUNCTIONAL PLAN FOR AN

# ILLINOIS LIBRARY TELECOMMUNICATIONS NETWORK

The Final Report from a
Library Services and Construction Act
Title III Project
Conducted by the
Northern Illinois Learning Resources Cooperative

Alice Calabrese
Project Director

Linda Bigelow
Project Consultant

Funding Awarded by the Office of the
Secretary of State / Illinois State Library

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## PREFACE

This report, "A Functional Plan for an Illinois Library Telecommunications Network," is the culmination of a year long Illinois State Library grant to the Northern Illinois Learning Resources Cooperative, a consortium of community college and other academic libraries in Illinois and a leader in the study and utilization of new technologies that will benefit users of our libraries.

Librarians and board members throughout the state of Illinois have long been aware of the impact of telecommunications costs and the fact that these costs may limit a library's use of automation. This project has met its specified objectives in developing a functional plan for Illinois library telecommunications in the future and technical work on the project is continuing under a FY'89 LSCA Title III grant. Both projects are commendable for their analysis of other telecommunications efforts in libraries throughout Illinois and the country and the potential relationship with the ambitious plans of the state of Illinois Department of Central Management Services for a statewide telecommunication network.

Special thanks are given to Alice Calabrese, project director, Linda Bigelow, project consultant, and Kathleen Lohman Bloomberg, associate director/Library Development Group who spent innumerable hours on the project on behalf of the Illinois library community.

Bridget L. Lamont
Director
Illinois State Library

**FUNCTIONAL PLAN FOR AN**

**ILLINOIS LIBRARY TELECOMMUNICATIONS NETWORK**

**Final Report of an**
**LSCA Title III Grant Project**

## SECTION ONE - INTRODUCTION

### PURPOSE OF GRANT

The purpose of the LSCA Title III grant for a Statewide Library Telecommunications Network was to research the requirements for a statewide electronic network which would provide for the transmission of high-quality voice, data, and video signals among public, academic, school, and special libraries in Illinois.

The grant was awarded by the Illinois State Library to the Northern Illinois Learning Resources Cooperative (NILRC), a consortium of forty-four community colleges and other academic institutions, most of which are in Illinois. NILRC has served the needs of its members since 1973, and operates under three long-standing goals: resource and information sharing, staff development, and cooperative projects.

This grant project had the benefit of the unique strengths of NILRC member colleges which include the comprehensive nature of their programs and services and the breadth of experience of LRC personnel. Illinois community college Learning Resources Centers have a major commitment to all forms of communications technology and experience in evaluating and selecting alternative delivery educational services. They provide educational opportunities to learn about emerging technologies as evidenced in two recent conferences on telecommunications (one statewide and one national). Illinois community colleges have a history of working cooperatively with other agencies to achieve common goals.

### METHODOLOGY AND GOALS

#### Goal I - Establish Human Resources Network

The NILRC Executive Director served as Project Director. A project consultant and a secretary were hired to assist her. A Local Advisory Committee was formed to address immediate staff concerns as they developed. A Statewide

Advisory Committee of eighteen members representative of all types of libraries as well as key governmental agencies was appointed by the Illinois State Library. Technical consultants were hired to help in the needs assessment process and to give technical advice as needed. (See Appendix A for complete list of project staff and advisory committee members)

Foundations were identified as possible sources of future funding. (See Appendix D) A Grants Committee was formed to develop and refine the grant application for a second year of LSCA funding which will provide the technical requirements for the network.

All eighteen library system directors were contacted, and presentations about the grant were given to various groups of librarians within most of the systems. (See Appendix C) A brochure, transparencies, and a promotional/educational videotape were prepared for the library system presentations. Presentations were also made at four conferences in Illinois. A press release was prepared and articles about the project appeared in newsletters of the Illinois Association of College and Research Libraries (IACRL), the Illinois Association for Educational Communications and Technology (IAECT), and the library systems.

Central Management Services (CMS), a department of the State of Illinois which is developing a statewide fiber optic backbone telecommunications network for the use of various state agencies, was contacted to determine the feasibility of libraries becoming part of such a network. Other governmental agencies contacted about the project included the Illinois State Library, the Illinois Board of Higher Education, and the Illinois Community College Board.

**Goal II - Gather Information on Existing Systems**

A literature search was conducted to help identify relevant statewide telecommunications networks and to provide current information on telecommunication technologies and trends.

A questionnaire was distributed to the State Librarian of each state to identify operating telecommunications networks. Site visits were made to observe networks in Iowa, Arizona, and Indiana with telephone follow-up interviews made to other identified networks.

An inventory of appropriate existing Illinois telecommunications networks was completed with site visits made to most of the networks identified. (See Appendix E)

## Goal III - Conduct Needs Assessment

The original intent of the grant was to design a survey instrument to be mailed to libraries within the state. Upon the recommendation of the Statewide Advisory Committee, the needs assessment process was redesigned to concentrate efforts on focus groups whose participants were reflective of multitype library visionaries in seven geographic areas across the state. Participants were selected from recommendations made by the advisory committees, the Illinois State Library staff, NILRC delegates, and System Directors and Presidents. (See Appendix B) Additional needs assessment responses were provided by the focus group facilitators, the Statewide Advisory Committee, and school librarians at the March Triple I Conference.

The focus group facilitators were selected and trained in discussion and brainstorming techniques and group dynamics skills. The focus group participants received educational packets containing articles on general concepts of telecommunications technology in preparation for the focus group process. The participants also received a glossary of telecommunications terms. (See Glossary appended to this report)

After the completion of the focus group process, the facilitators met to compile the results. These results served as the foundation for the strategic planning session of the Statewide Advisory Committee held in late April. It was at this meeting that primary network strategies were developed.

## Goal IV - Define Functional Design Criteria

Using the strategic plan developed by the Statewide Advisory Committee, and with the assistance of the technical consultants, functional design criteria for the Illinois library telecommunications network were developed and compared to existing state capabilities.

## SUMMARY

The Northern Illinois Learning Resources Cooperative (NILRC) was awarded an LSCA Title III planning grant to research the requirements for a statewide library telecommunications network and recommend the most cost-effective and efficient way to implement such a network. A needs assessment was completed through the use of focus groups, telephone and personal interviews, advisory committees, and other relevant contacts.

Integrated voice, data, and video networks outside Illinois were identified and studied. Existing library and education telecommunications networks within Illinois were identified and inventoried. Information about the project was provided through promotional materials and presentations at Illinois library meetings and conferences. Functional design requirements of the network were developed from the results of the needs assessment. A final report containing recommendations for the development of the network was prepared for the Illinois State Library.

## SECTION TWO - NEEDS ASSESSMENT

### PROCESS

The purpose of this planning grant was to research the requirements for a statewide electronic network for Illinois libraries. There were two major questions to be asked: "What were the future service needs such a network would address?" and "Was there an interest in the library community for a telecommunications network?" Before these questions could be answered, it was necessary to conduct a needs assessment. The information needed was developmental in nature, dependant upon the vision of library leaders who recognized the potential of new technologies to improve service. Therefore, the project staff determined, and the Statewide Advisory Committee concurred, that a combined focus group/nominal group approach would be the most appropriate information-gathering process.

A focus group is a group assembled for the purpose of looking in detail at a single aspect of a broader topic; in this case, telecommunications as it affects library services. The strength of a focus group brainstorming process is that it is a qualitative way of discovering key issues. In a nominal group process, the participants develop lists of ideas on their own before interacting with the group. Each person then shares his or her ideas individually. By combining focus group and nominal group techniques, everyone participates, all ideas are heard, a wide range of perspectives are presented, and the benefits of synergy through "piggybacking" onto ideas of others are realized (E. G. Bormann and N. C. Bormann, 1972).

Once the focus group approach was decided upon, succeeding steps followed smoothly. Focus group facilitators were selected from the NILRC membership based upon their technological background and experience in leading groups. A consultant was brought in for a one-day workshop to train the facilitators in group dynamics and brainstorming techniques as well as to develop the format to be used at the seven focus group sessions. The project staff served as recorders at each session.

Names of library visionaries in Illinois were solicited from the Illinois State Library, the Statewide Advisory Committee, NILRC, and Library System Directors and Presidents to serve as participants in the focus group sessions. Every attempt was made to provide broad representation of types and sizes of libraries in each geographic region while limiting the group size to an

effective number of participants. Participants were provided an educational packet prior to their meeting which included information about the grant, the purpose of the focus group sessions, and general background articles about the various telecommunications technologies.

At the focus group sessions, participants were asked to list, based on their own unique perspectives, ways they envisioned their libraries and/or patrons using a library telecommunications network. They were encouraged to think creatively and not let money be a limiting factor. What resulted was a comprehensive list of expanded and enhanced services that libraries would like to offer that recognized current trends in information sharing and telecommunications development. There also emerged a thoughtful list of concerns that should be addressed when planning and implementing a library telecommunications network. Additional mini-focus group sessions were conducted with the focus group facilitators, the Statewide Advisory Committee, and school librarians at the spring Triple I Conference.

## RESULTS

In terms of the process, participants at each session expressed their appreciation for the opportunity to contribute ideas, to be involved in a developing project, and to learn from each other. There was excitement generated through the cross-pollination of ideas and points-of-view. In addition, cautious optimism was expressed about the fact that the topic of a statewide approach to telecommunications was being addressed. This was tempered, however, by a quiet skepticism that such a network would actually become a reality. Although the objective of the focus groups was to obtain reactions of representatives of the library community to a library telecommunications network, other ideas were also generated concerning services that could be provided through such a network. The primary focus, however, remained on telecommunications.

### Concerns

While there was great interest in a library telecommunications network, there were also legitimate concerns expressed concerning such a network. The first concern was that small libraries not be left out of the plan. A shared view at each of the sessions was that too often statewide projects benefitted the larger, technologically-rich institutions while the smaller institutions were financially unable to participate.

Suggestions to facilitate inclusion included shared-cost formulas based more on usage than distance, state subsidies for network start-up, and special support for under- or unserved areas.

A second concern was that a statewide office with the responsibility for planning, coordinating, monitoring, promoting, and supporting library use of telecommunications be established.

A third concern was that user support services be available for the network including start-up support, training, documentation, an ongoing "help-line", and technical support.

A fourth area of concern was for the development of standards so that the goal of universal compatibility and connectivity between and among various networks would be facilitated. Along with this was the additional concern that interfaces and gateways (connecting links) be developed to accommodate existing networks.

With a statewide network comes concerns about access. Who will have access (just libraries, business and industry, home)? Who will have access priority? How will security be maintained? How will confidentiality of patron records be upheld?

Other concerns were for the network itself. How will it be managed and governed? How reliable will it be?

Overlaying these concerns was the expressed desire that the cooperative nature of the library communications structure in Illinois be maintained as libraries move into telecommunications network planning.

## Services

Responses to the question of the future service needs which the telecommunications network would address ranged from the whimsical ("Beam me up, Scotty" document delivery) to the practical (fax in every library at a reasonable cost) to the visionary (real-time home access to databases, programming and library materials including search, retrieval, and full-text capabilities). These service needs can be grouped into eight categories.

### Linkages

The linkage needs of libraries recognized the need for standards, the desire to have a menu of telecommunications carrier options, the importance of gateways or connections

between databases, and the value of a move toward universal connectivity. By using international standards and communication protocols for the network, the user need only know the local protocol to access the network. The network then translates into the common protocol of connected systems.

It was important for this network to be aware of the Linked Systems Project involving the Library of Congress, the Online Computer Library Center (OCLC), the Research Library Group (RLG), and the Western Library Network (WLN). It was also deemed important that the network provide numerous "invisible" gateways (both inter- and intrastate) to databases and commercially-available services and vendors so as to facilitate single-call searching. A somewhat different link was one that would automatically connect a searcher to a human being for help once they reached a strategic point in their online search that indicated the searcher was having difficulty. Another kind of linkage needed was the development of interfaces that would allow existing non-compatible systems to be connected.

Specific connections identified were the need for interconnecting existing bibliographic databases into a statewide online catalog with hold and reserve capabilities; the need for a statewide patron database to facilitate interlibrary loan; and the need for cost-effective connections to cataloging databases that would allow simultaneous, automatic input of a cataloging record into all participating databases (local, regional, state, national).

Libraries also wanted to establish connections to cable companies for programming distribution; to business and industry for career information; to library suppliers for pricing information, evaluation/reviews of products, and contract negotiations; and to other libraries in a teleconferencing network to reduce time and travel commitments for meetings.

An additional linkage needed was for electronic mail for which a wide variety of applications was described. The libraries wanted electronic mail available on every desk for shared problem-solving, for notes and queries, and for reference. They wanted to use electronic mail for access to government agencies, for distribution of memos with capability of reminders of items needing action, for joblines and community bulletin boards. They also wanted to use it for jointly writing reports and research projects, for registration for meetings, and for numerous other uses.

## Access

The focus group participants expressed the need for speedy and universal access to information with no concern for institutional boundaries. They wanted to be able to use any appropriate technology. They wanted the ability to search on the spot while the patron is there and be able to retrieve information once it is located.

They did not want to be limited to providing just bibliographic information. They wanted to provide access to non-bibliographic databases, such as census reports, with ability to do data manipulation.

They wanted to provide online, user-controlled preview of audiovisual materials from remote sites with the accompanying ability to download and use the materials. They wanted access to full-text, graphic, and other searchable, visual databases whether available in Illinois, out-of-state, or internationally. The medium should not be a barrier to information.

They wanted to provide businesses and corporations with access to online reference and research services, special needs students with online access to materials at their educational level, the general public with dial access to library databases at the patron's convenience. They wanted to provide interlibrary loan access to resources of the state by expanding statewide access to ILLINET Online and the library systems' databases.

It was agreed that access would be facilitated through reduced costs to all libraries if state contracts for commercial databases were negotiated. In a slightly different vein, they wanted to expand access to high technology by making available to the general public electronic mail, facsimile (fax), videophones, and other telecommunications capabilities.

## Shared Resources

It was evident that librarians saw the use of telecommunications as a means of stretching limited budgets through resource sharing. Shared staffing suggestions included providing an online directory of staff with technical expertise, linking computer systems in order to share programmers and troubleshooters, using video to screen potential speakers, and sharing reference experts through an online reference back-up service.

There was a need to share library programming at different sites simultaneously, such as story hours at day care centers, booktalks at senior citizens centers, luncheon sites, or Sunday Schools; and specialized public and cultural programming such as a program from the Art Institute or a satellite program on a current topic. It was felt that small rural libraries would particularly benefit from video access to these childrens' and adult programs.

There was also a need to find new ways to promote the sharing of materials. Online connections to shared bibliographic databases would enhance cooperative coordinated collection development. Audiovisual collections could be expanded by transferring and downloading public domain video, audio, and microcomputer programs. Knowledge and data could be shared online by researchers conducting research in similar areas.

**Databases**

Not only did the focus group participants express a need to expand and improve upon existing databases and open up access to them, but they had very explicit ideas for creating databases to meet specific information needs. Several databases suggested would serve a clearinghouse role--to collect, organize, and update information on such topics as developing technologies and their associated products and resource people; teleconferencing information; and directories of who to contact on various issues. Also suggested were a consumer guide to library and instructional equipment and software which would include critical reviews; information on state and federal grant projects; or a library news service to replace numerous newsletters.

Other databases suggested were visual in nature, including a video database of toys and puzzles for patron viewing and selection; a video database of "How to" information (auto repair, taxes); and a database of placement and promotion job interviews where the candidates could also include references via video. Community databases could show prospective businesses, students, and others views of the community's housing, schools, industry, and so forth. An online mapping of state agencies and libraries could provide directions, landmarks, location of offices, and contact persons.

Additional kinds of databases suggested included an on-demand health network for public access; a database of exchanges for multiple copies, equipment, and other materials; statistical reference material; and an online database for pamphlets, corporate reports, and government documents under 50 pages with full-text, key-word access.

## Planning and Development

Many of the participants believed a library telecommunications network would help them address some of their planning and development needs for their institutions. They could visualize it being used for interactive statewide planning (ILA, System board meetings, Illinois State Library Advisory Committee), and as a report mechanism for online reporting to state agencies.

The network could serve as a public relations and awareness vehicle, as a time management tool through the use of interactive teleconferencing for committee meetings and as a way of conducting community surveys and opinion polls. Telecommunications could provide a way of rapidly moving information among institutions and for contributing management data that is frequently asked for in questionnaires to a central source for access.

They believed that such a network would help reduce costs and provide flexibilty in communications through bulk purchasing of services. They also agreed that it was important that information be compiled for libraries which would outline telecommunications options and costs.

## In-Service Training and Professional Development

Strong interest was expressed in using the video component of the network to provide in-service training and continuing education kinds of activities. By using video (either through programming or teleconferencing) to bring meetings and workshops into the library itself, more of the staff could participate and benefit from the activities.

Particular suggestions included providing in-service training for staff in familiarization and use of high technology; demonstrating particular techniques, such as preservation of materials; and serving as a training tool for new staff and volunteers. Other suggestions included providing workshops such as story-telling; making available statewide continuing education programs at the local level (although not necessarily in every library); providing video access to state and national conferences for local libraries; and providing consulting assistance through the use of interactive video.

## Distance Learning

Distance learning is using technology to take education to the students wherever they are located. Community college learning resource centers and school library/media centers

are particularly interested in this aspect of telecommunications because they often have the responsibility for providing the delivery system needed for distance learning in their institutions.

Most of the potential uses cited involved the use of video via two-way teleconferencing capabilities or through satellite programming (both uplinking through a central site and downlinking for redistribution) or through hybrid networks involving technologies like instructional television fixed services (ITFS), microwave, and cable.

There were many distance learning needs identified, beginning with the need to network public libraries, community colleges, schools, colleges and universities. This network would provide access to education at remote sites, permit shared programming, and promote and utilize such educational resources as literacy programs and university extension programs. It was believed that such networking would result in greater interagency cooperation in programming.

There was a need to provide patrons with access to college credit classes directly in the home. There was a need to provide low enrollment courses such as foreign languages or advanced math on a regional basis.

A lot of interest was expressed in bringing degree-applicable graduate library courses to librarians in the workplace using interactive video instruction and teleconferencing capabilities. Other educational uses of the network included interative video computer-aided instruction, online grading of tests (e.g. nurse's exams) for quicker turnaround time, and online student registration. Students could meet with faculty without coming on compus. Two-way conferencing would allow faculty to present demonstration interviews for library classes and also allow library classes to unobtrusively observe libraries in action.

**Document Delivery**

It was recognized that locating library resources is not enough. Libraries wanted to provide easy, inexpensive, accurate, high-speed transmission of full-text documents and images from any electronic source to their patrons whether in the library, at home, or at the office. They wanted to see interfaces developed for scanning so that graphic and photographic images and print could be directly entered into the computer.

Once resources were located online, they wanted to be able to download selectively. They wanted to see continued development of facsimile transmission so that it becomes more cost-effective, less labor-intensive, uses plain paper with high quality reproduction, and is available in every library. They wanted to provide image and document transmission fax-to-fax, computer-to-computer, and fax-to-computer. More sophisticated document delivery was seen as enabling libraries to share rare materials without affecting their condition and as allowing for downloading into a printed form no less attractive than the original.

## CONCLUSIONS

In response to the question, "Is there any interest in the library community for a telecommunications network?" the answer was a resounding, "Yes!" The primary reason, echoed in all of the focus group sessions, was to provide a cost-effective means of expanding services through shared arrangements using telecommunications. If such a network would not reduce costs, then it should at least allow for expansion without parallel cost increases.

Some concerns raised were that small libraries not be left out of the network, that statewide coordination take place, that user support services be provided, that standards be developed, that access be defined, that the management and governance of the network be cooperative, and that participation be voluntary.

Overall, the participants wanted a comprehensive system that satisfied multiple needs for voice, video, and data applications. It was recognized that many of the service needs were interrelated, but for discussion purposes, the responses were grouped into eight large categories: linkages, access, shared resources, databases, planning and development, in-service training and professional development, distance learning, and document delivery.

Within these eight categories, the focus group participants identified numerous connections and services needed to provide improved library service. They understood that a library telecommunications network would not create these services but would provide the "highway" or "pathway" over which such services could be implemented.

## SECTION THREE - CURRENT LIBRARY AND EDUCATION TELECOMMUNICATIONS ENVIRONMENT

There are already multiple library and education systems and networks existing in Illinois that could benefit by having access to a statewide telecommunications network. One of the goals of this project was to identify and inventory those networks to provide a more complete picture of the breadth and depth of the current use of library telecommunications in Illinois.

It was also the goal of this project to identify statewide or regional integrated networks that might serve as a model or offer guidance for the Illinois project. Over the course of the study, interviews were conducted with key persons in each existing and proposed network identified, the results of which are described on the following pages. (See Appendix E for a list of the interview questions and a list of persons interviewed)

### NETWORKS IN ILLINOIS

#### Voice

Voice networks are described in the literature by the acronym POTS - Plain Old Telephone Service. Libraries in Illinois generally use the common carriers (e.g. Illinois Bell, AT&T, Sprint) for their telephone service with each library making its own decision as to which carrier to select. Some libraries as well as library systems provide toll-free numbers for their patrons or members when geographically dispersed over large areas. Toll-free numbers are also provided for access to special services such as materials for the blind and physically handicapped.

#### Data

Automation in libraries in Illinois has proliferated over the last few years with a wide variety of approaches selected.

##### Local Library Systems Automation Projects (LLSAPS)

According to the 1988 revised draft of the Plan for Funding Automated Resource Sharing in Illinois Libraries developed by the Illinois Library Automation Committee, all eighteen library systems are participants in local library systems automation projects (LLSAPS) at thirteen sites. These projects represent the collections of 316 participating libraries: "235 public, 6 special, 25 academic, 32 school

libraries, and the 18 library system headquarters" (p. 17). Various vendors have been used, and about 1,200 terminals are connected to the projects.

Generally, the participants in LLSAP networks are connected to the central site locations by either dedicated lines or dial access, using common carriers and a variety of multiplexors and modems. The library systems use dial access and dedicated lines to link to ILLINET Online/LCS.

The LLSAPS projected that 212 libraries would like to be added to the networks over the next five years, requiring about 1,500 additional terminals. Two problems facing the LLSAPS are upgrading a substantial number of the bibliographic records to MARC format and implementing authority control of records.

According to recent telephone surveys, about half of the community colleges in Illinois are members of OCLC and Serials in Illinois Libraries Online (SILO). Again, the telecommunication technology used includes dedicated lines or dial access. About one-fourth have facsimile transmission capabilities. About half now have, or are planning to put in place in the near future, automated circulation systems. Of those who now have such systems, most are members of a consortium, usually their regional library system's network.

Only a few of the school libraries are members of one of the LLSAPS or other consortia. Those who are automating their circulation functions frequently select an in-house system as appropriate to their needs.

While most of the LLSAPS include only local system members, one of them, the **Resource Sharing Alliance of West Central Illinois (RSA)**, covers four library systems. RSA provides some useful insights into the nature of consortial arrangements and governance structures.

The Resource Sharing Alliance was established in 1984 so that libraries would be able to afford an online circulation system and a public access catalog. It is a not-for-profit corporation with sixteen multitype members from four library systems (Great River, Western Illinois, Illinois Valley, and Corn Belt). It includes two private universities, the four systems, and ten public academic institutions and public libraries.

The system uses UTLAS T/Series 50 software and Tandem hardware. The members are linked to the central site by dedicated telephone lines and several statistical multiplexors.

The corporation is operated by an Executive Director and a five-member governing board made up of representatives from the four systems and a member-at-large from the user's group. Because each member participates actively in one of the five volunteer committees--Executive, Advisory Council, Financial Planning, Database Management, and Troubleshooters--RSA is able to function with a minimum of paid staff.

RSA, while originally funded through an LSCA grant, is financially self-sustaining through membership fees. Fees are based on a formula that divides telecommunications costs and capital development costs equally among the members and allocates the remainder of the budget based on the number of ports used.

The organizational structure of the Alliance has worked well for them. Their main problems are keeping costs down and determining the source of problems during down-times since the AT&T divestiture. Plans for the future include adding new members both from within the four systems and within Illinois; continuing to upgrade the system; and participating in linking projects with other UTLAS networks such as the Chicago Public Library.

**ILLINET Online/LCS**

ILLINET Online, an enhanced version of the Library Computer Systems (LCS), is a statewide automated resource-sharing network with two components:

.LCS - Library Computer Systems (circulation system)
.FBR - Full Bibliographic Record (online catalog)

The two databases operate with two software packages linked on one terminal. The system is used as a local circulation system, as a card catalog, and for interlibrary loan functions.

LCS originally grew out of a need of the University of Illinois departmental libraries for a shared circulation system. The system was installed in the mid-1970s and was based on the original LCS network design developed in the late 1960s.

In fiscal year 1980, the Illinois Association of College and Research Libraries/Illinois Board of Higher Education (IACRL/IBHE) Liaison Committee selected LCS as a pilot project to promote a statewide resource sharing project. Both Higher Education Cooperation Act (HECA) and Library Services and Construction Act (LSCA) funds were provided to spread access to LCS to academic libraries across the state. There are now twenty-nine academic libraries,

eighteen library systems, and the Illinois State Library using 800 terminals on the network. The network configuration is being redesigned to take advantage of new technological developments, and new services are being added.

Currently, libraries access ILLINET Online/LCS through either dedicated lines or dial access using a network of multiplexors and modems. The Assistant Vice President for Telecommunications at the University of Illinois pointed out in a 1987 report ("Expansion and Enhancement", 1987) that a review of the network structure associated with LCS indicated that a new structure was needed to "provide the ability for a terminal to reach multiple applications, flexibility in the routing of network traffic to share facilities where appropriate to reduce overall cost, and network management facilities that provide for improved error detection and facility testing" (p. 33).

A new network configuration was recommended which included the following elements:

1. All multiplexors will be replaced by IBM 3708's....

2. All remote modems will be replaced by IBM 3xxx modems. Each of these modems provides for the connection of a number of IBM 3708's. In addition, these modems support the remote network monitoring error detection and remote configuration feature of SNA.

3. New front end processors will be installed to replace all existing units.

4. Circuits from downstate Illinois will be routed to the Urbana/Champaign campus of the University of Illinois thus reducing the overall circuit cost.

5. All existing terminals will remain the same.

6. Only very slight changes will be made to any software. (pp. 33-34).

This conversion process has already begun and is expected to be completed by Fall of 1988.

The FBR component of ILLINET Online is being developed to add online public access catalog capabilities to the LCS network. Again, LSCA and HECA funds were provided to test the feasibility of a public access catalog to be shared by academic and public libraries and to help develop the

database. ILLINET OCLC tapes were used to create a union catalog containing 4.5 million records from 800 libraries. The creation of the union catalog is expected to be completed by December 1988.

The holdings records are in the LCS circulation component. University of Illinois programmers created a link between LCS and FBR so that locations of items found in the catalog could then be identified. A University of Illinois linguistics professor created a user-friendly interface that allows the user to easily search local holdings and system-wide holdings and to then check out the materials located.

While ILLINET Online is a project of the Administrative Information Systems and Services (AISS) division of the University of Illinois, it is governed by the Illinois Library Computer Systems Organization (ILSCO) which has two primary committees:

> The Policy Council, composed of LCS library directors; representatives from the University of Illinois administration, the Illinois State Library, the Illinois Board of Higher Education, the Library Systems Directors Organization, and the OCLC Users Group; and two members-at-large from non-LCS libraries.
>
> The Operations Committee, composed of members from each LCS library.

According to the Manager of the LCS Library Systems User Services, governance has "evolved into a committee structure that works well with a strong spirit of cooperation in evidence."

ILLINET Online has been funded as a University of Illinois project and through grants but is moving toward additional financial support from LCS users for development funds.

A formula is being developed based on a flat rate per user plus the user's percentage of the total network transactions for the previous year. ILLINET Online is always looking for a more cost-effective way to carry traffic and is looking for gateways that would make it easier to get into other systems from one access point. Currently, it is difficult for LCS libraries to borrow from non-LCS libraries because of the many protocols that have to be used.

Future plans include expanding both dial and direct access to ILLINET Online to other academic and non-academic libraries, investigating the possibility of adding non-OCLC records to the database, and "refurbishing" the LCS software and developing new interfaces. LCS is on the verge of adding a large increment of terminals over the next few years, from the current level of 800 terminals to 1,600 terminals by 1991.

## ILLINET/OCLC SERVICES

Organizationally, ILLINET/OCLC Services is a component of the Library Development Group of the Illinois State Library. The service provides training sessions for ILLINET/OCLC participants as well as for new and potential OCLC users.

Illinois libraries who wish to join OCLC, the not-for-profit national shared cataloging cooperative, may do so through ILLINET/OCLC and realize significantly reduced service costs. ILLINET/OCLC divides the Illinois telecommunications bill received from OCLC for dedicated data lines by the number of modems in the network (typically, $30,000 per month by 185 modems) thus distributing the costs equally among participants. More than 300 libraries, over a third of which are special libraries, take advantage of this service.

ILLINET/OCLC Services has a Manager and a staff of three or four who administer the service, offer 70-85 training sessions per academic year for new, potential, and on-going members, answer questions, speak at meetings, and conduct site visits. They are assisted by a group of volunteers from the Users Group who provide additional training sessions.

Nationally, OCLC is addressing some of the problems associated with its service, including re-designing the system and using more off-the-shelf equipment. While still using its propietary protocol, OCLC is moving toward using a standard protocol in the future. Because OCLC is also planning to change its telecommunications pricing structure, it is expected that ILLINET/OCLC's costs will probably increase over the next two years. According to the Manager, the proposed Illinois library telecommunications network has particular implications for dial-access users of OCLC.

## Illinois Network of Libraries Serving the Blind and Physically Handicapped (INLBPH)

The Illinois Network of Libraries Serving the Blind and Physically Handicapped (INLBPH) serves the library material needs of print-handicapped individuals who are eligible for service as defined by the National Library Service of the Library of Congress. It is a dispersed, statewide network, recently reconfigured, of six Talking Book Centers which provide localized service. The network is coordinated and managed by the Illinois Regional Library.

The telecommunications used for the network include two hub site locations and 3,002 dedicated lines on hub spurs to other dispersed sites, all of which are channeled through central processing in Chicago. This statewide telecommunications package also supports the LCS interlibrary loan functions of the eighteen library systems in Illinois.

The Illinois State Library is the administrative agency which contracts with the Chicago Public Library for regional library services and with five other systems for Talking Book Center services. These services are coordinated by the Illinois Regional Library. All materials and equipment are provided free of charge by the Library of Congress' National Library Service.

The Library of Congress network was established in 1931 by an act of Congress, the Pratt-Smoot Act, with the Chicago Public Library designated as one of eighteen charter regional centers. The service was expanded in 1967 through LSCA grants which added sub-regional library services in Illinois. The network has been funded since fiscal year 1974 by a General Assembly appropriation administered through the Secretary of State's office.

The plan for the future of the Illinois Network of Libraries Serving the Blind and Physically Handicapped is to stabilize the network through this reconfiguration transition period.

## NovaNET/PLATO

PLATO was started in 1960 with computer-based education as its primary focus. Today it is a multi-faceted system called NovaNET which is as much a communications network as an educational network. Sixty percent of the 1,800 terminals connected to the main computer at the University of Illinois are at Illinois locations. Subscribers to NovaNET/PLATO may choose either dial access or dedicated line access to the main computer. Dial access users pay for telecommunications based upon frequency of use and

distance from the University of Illinois. Dedicated line users pay a flat rate per line.

Telecommunications costs have been reduced because of new high-speed processors and combined satellite/telephone line connections. The cost of PLATO terminals has been reduced. Subscribers may now also choose to use their existing terminals. NovaNET has added new services such as transparent access to other networks. Because of these changes, NovaNET expects to expand to 4,000 terminals in the near future. Currently, PLATO is primarily used by educational institutions, but the Assistant Director of the Computer-Based Educational Research Laboratory (CERL), expects usage to expand to libraries. He described the service as an excellent communications tool to link libraries via electronic mail and bulletin board functions. It could also serve as a gateway providing access to other networks such as ILLINET Online/LCS and as an instructional resource for literacy training.

NovaNET/PLATO is the responsibility of CERL at the University of Illinois. Potential Illinois users contract with the University of Illinois for service. User fees are based on cost recovery. The main problem faced by NovaNET was making the service affordable enough to expand the user base, and that problem is being addressed. Future plans include adding participants and services. The proposed library telecommunications network is seen as potentially enhancing those goals.

**SILO**

Serials in Illinois Libraries Online (SILO) is one of over seventy serials union lists on OCLC. Over 340 multitype Illinois libraries (over 100 of which are health science libraries) contribute their serials holdings to the statewide list which now contains about 270,000 local data records.

SILO began as an LSCA grant project at Northern Illinois University in 1982 and evolved into a permanent part of the ILLINET/OCLC Services of the Illinois State Library in 1987. The primary use of SILO is for interlibrary loan of serials.

Access to SILO is provided through the Serials Control Subsystem or the Interlibrary Loan Subsystem of OCLC using dedicated lines or dial access. Offline products (paper, microfiche, or magnetic tape) are also available twice a year and are used by non-OCLC SILO participants, of which there are about 130 libraries.

ILLINET/OCLC Services is working to provide group access as selective users of the interlibrary loan subsystem to non-OCLC members who are SILO members. This would allow non-OCLC members to access the subsystem at the same cost as a full member but would not require them to contribute cataloging information.

Initial problems faced by SILO were those of recruitment and relevancy. Because the initial grant was a Title III grant, membership had to be very selective to be sure all types of libraries and all segments of the population were included. This meant that some key holdings were not included simply because of lack of time and funds.

A goal of the grant was to create one place where libraries could go to find all the serials available in the state. This created a challenge to demonstrate the relevancy of a statewide union list to groups who did not believe they required access to the whole state and that their individual union lists were sufficient.

Plans for the further development of SILO include adding the holdings of key libraries such as law and business libraries, state universities, and library systems so that SILO will become a reference tool truly representative of the state's serials holdings.

**Facsimile Transmission (Fax)**

The feasibility of using facsimile transmission (fax) for document delivery in libraries was demonstrated through an LSCA grant received by Carl Sandburg College in the early 1980's. Fax particularly proved to be a cost-effective and time-efficient way of providing periodical articles for interlibrary loan. The number of library agencies participating in the fax network has grown each year from six or seven libraries in west central Illinois to nearly 200 libraries statewide. The fax network uses voice-grade telephone lines for transmission. Many libraries have dedicated lines for fax. For others, their regular telephone lines serve a dual role and are used for both voice and fax.

The general enthusiasm for fax for providing faster service was reflected in three different library settings in west central Illinois.

The Western Illinois Library System (WILS) uses the fax network to transmit interlibrary loan requests, documents, and communications of all sorts where time is an important factor. WILS is a member of the Resource Sharing Alliance

which uses fax for transmitting many interlibrary loan requests. This eliminates at least two days from the turnaround time for document delivery. WILS uses fax for many applications including sending information to their attorney's office. Western Illinois Library System has found fax to be so useful for linking their geographically distant libraries that they will be placing additional fax machines in eleven smaller libraries during the coming year. The Library System will provide a toll-free number for the libraries to use to help with telecommunications costs.

While WILS has a dedicated line for fax, many of these new machines will share the telephone lines with regular voice usage. WILS makes frequent use of reduced rates by stacking and transmitting documents all around the state during the evening hours. Their costs for fax range from $24-$30 per month.

Illinois Central College uses fax extensively for communications. As a member of the Resource Sharing Alliance (RSA), they print information from the online public access catalog screen and fax it to the owning library for interlibrary loan requests. They fax ALA inter-library loan request forms to non-RSA libraries. They will respond to interlibrary loan requests using fax unless the requester specifies a different method of delivery or unless the document is more than ten pages in length. They also use the fax network for electronic mail kinds of transactions. Illinois Central has a dedicated line for fax and uses it whenever the need arises. They average about $85 per month for fax costs and consider it money well spent because of improved service.

The St. Francis Medical Center Library in Peoria uses fax extensively for interlibrary loans of journal articles. The Library sends, receives, and fills requests by fax whenever possible. In a recent study, about 75% of the monthly requests were received by fax. The Library does not have a dedicated line for fax but uses their regular telephone line. Urgent requests are filled by other libraries using fax transmission, but non-urgent documents are usually sent using the statewide van delivery service. The Library not only has fax access to the Illinois network but to libraries in other states and to the National Library of Medicine.

Timeliness is a key factor in the health sciences, so fax has rapidly become an important tool in the health science libraries. The St. Francis Medical Center Library transmits requests whenever needed and has found that their costs average about 44 cents per page.

## Video

Both public schools and community colleges are interested in telecommunications as a vehicle for providing distance learning opportunities for their students. Frequently, the library/learning resources center staff have the responsibility for providing the technology for distance learning, and that technology usually involves the use of video.

Video can be provided by several means of transmission: microwave, cable (or broadcast television), satellite, or fiber optics. Microwave requires line-of-sight transmission between the sending and receiving antennas. Transmission to a single location is called point-to-point microwave. Transmission from a location to several locations (omni-directional) is called multipoint microwave. A specific type of broadcast which is granted by the FCC for educational use and which uses microwave is called ITFS (Instructional Television Fixed Service).

Cable television distributes audio and video signals for direct use on standard television sets.

Satellite transmission involves sending the video signal from an origination point on earth (uplink) to a particular satellite orbiting the earth which in turn transmits the signal back to multiple locations on earth that have the proper antenna (downlinks) to receive the signal.

Fiber optic transmission of video sends optical waves over fine, hair-like strands of transparent glass or plastic fibers. None of the library and educational networks in Illinois that were inventoried yet use fiber optics.

### Microwave

#### Multipoint

##### Instructional Television Fixed Service (ITFS)

**Triton College**, which is located in the greater metropolitan Chicago area, has in place an ITFS network created to deliver instruction within the College district, serve as a communications link with the community, expand recreational viewing in the area, and provide telecommunications services to the district's business community.

The network includes receive sites at fire stations, high schools, nursing homes, public libraries, and cable

companies. Triton provides programming 10 hours per day, six days per week, from three sources: live from Triton's three-camera production studio, from tape, or from satellite downlinking. Triton also has satellite uplinking capabilities and has produced national teleconferences.

Programming over the network includes such areas as state-approved continuing education courses, staff development programs, recreational programs, "visiting professor" lectures, career planning and placement activities, and telecourses.

Triton's experience with video underscores the need for a library telecommunications network to provide for multiple capabilities, redundancy (backup systems), and reduced telecommunications costs. Triton also demonstrates the successful use of various telecommunications technologies and services (satellite, microwave, ITFS) to create a viable network.

**Point-to-Point**

CONVOCOM (Convoke to Communication) was established to bring local and regular public television broadcasts to west central Illinois. It also provides non-broadcast telecommunications capabilities via microwave links covering 32,000 square miles. The not-for-profit network provides video teleconferencing for formal and informal instruction, including credit and non-credit courses, continuing education programs, and training for state agencies and for industry.

The concept of bringing educational television to the western part of the state was discussed as far back as 1963, and in 1976, the Illinois Board of Higher Education awarded a HECA grant to promote shared educational programs in sparsely populated areas. It was in the early 1980s that CONVOCOM received capital grants from the National Telecommunications and Information Administration (NTIA) on a matching basis to build the system. The network expanded its membership to include industry and public schools, and also became self-supporting. Funding now comes from contractual arrangements, grants, and subscription donations.

The network is a two-way, dedicated, analog, point-to-point microwave network that has three legs, each of which can run different programs. There is one video path each way accompanied by audio. Half of the system has an additional two audio paths that could be used for conferencing. All switching on the network takes place in Peoria.

CONVOCOM is a consortium of universities, community colleges, public schools, industries, public television and radio stations, and cable systems. It is governed by a 27-member Board of Directors. For every charter and affiliate member represented on the Board, at least one public member is appointed. There is also an Executive Committee of no more than 15 members. The Board meets twice a year, the Executive Committee an additional three times.

The mission of CONVOCOM is to serve as a delivery system, serve as a mediator of the consortium, and serve as a catalyst for educational telecommunications to take place. Because CONVOCOM is a cooperative consortium with substantial in-kind contributions made by the members, the President of the consortium has the responsibility of seeing that everyone continues to head in the same direction. The President stated that the consortium gains strength from being self-sufficient with a variety of sources of revenue. He recommended that a similar type of network not rely just on point-to-point microwave between communities but also add ITFS sites within a community to increase convenience and access to the network. He also suggested that libraries have an advantage in setting up a telecommunications network because they already do cooperate, not just talk about it.

Future plans for CONVOCOM include adding an extra video path in order to provide separate broadcast and non-broadcast networks, expanding the reaches of the network both in-state and out, planning for future growth both in technology and programming, and providing voice and data services to outside users.

## Combined Point-to-Point/ITFS

**Waubonsee Community College**, located fifty miles directly west of the Chicago Loop, saw a need to serve the rural educational institutions in their district and so formed the Telecommunications Instructional Consortium (TIC). In the Fall of 1988, Kaneland, Plano, Waubonsee Valley and Oswego High Schools will begin offering classes over the two-way video and audio microwave network. The potential of the network is to build to twenty participating high school districts.

The system takes advantage of several technological means to communicate:

- Point-to-point microwave connecting the college with the high schools

- .ITFS--two channels of low power television signals providing programming for the adult learner and for cooperative programs with business and industry
- .C-band and Ku-band satellite downlinks for teleconferencing capabilities
- .Inter-campus cable system with origination and return for audio and video
- .Plans to connect the college's two campuses for data transfer

The College applied for and received a grant for $128,000 for the ITFS portion of the project. Waubonsee presently transmits over two channels. Their broadcast license allows for expansion to include an additional two channels. The College President has been actively involved in the fundraising aspect and the recruitment of other educational institutions to participate in this network. The Board of Trustees has also been very supportive of the project. Two full-time employees--a programmer and a technical manager--have been hired to implement the system.

TIC is a good example of a cooperative telecommunications consortium bridging communications between the community college and high schools and the comunity college and business and industry.

**Cable**

Several Illinois community colleges as well as some public schools and public libraries are linked to cable systems in their areas in order to provide educational and informational programming for their constituents. They offer production facilities and lease telecourse programs as well as provide other programs for distribution over the systems.

**Community Colleges**

Eleven of the NILRC community colleges are working actively with their local cable companies to provide programming over local access channels. Most of the college districts have multiple cable franchises within their boundaries. This has proved to be a challenge in coordinating programming activities among the various cable companies to provide district-wide access for the colleges' students. Some parts of the state, notably the western and southern parts of Illnois, are so sparsely populated that cable franchises do not cover a significant portion of a college's district, so cable programming is not pursued. However, in more populated areas, community college connections with the local cable companies have proved to be mutually beneficial.

The **College of DuPage** has about twenty cable companies in its district. The College would like to see more interconnections among those companies so that it would become more realistic for DuPage to produce and distribute programs. However, the College does have a connection with the cable companies in Glen Ellyn and Wheaton over which they provide about fifteen hours per week of copyright-free programs, telecourses, and locally-produced programs. Once a month they broadcast a magazine-type program called "Images."

The **College of Lake County** provides complete videotape sets of credit telecourses for broadcast over four cable systems in the college's district. These four cable systems cover about 75% of the College's population and generate about 15% of the College's telecourse enrollments.

**Elgin Community College** has a hard-wire connection from their control room on campus to Centel of Elgin. Centel funded about two-thirds of the initial cost of the equipment needed for the control room. The College uses the Centel educational channel to provide 34-40 hours per week of college-level courses during each semester. They broadcast telecourses during the day and then re-broadcast the programs in the evening. Cable accounts for about 10% of Elgin's total telecourse enrollments.

**Harper College** has a direct connection to American Cable Systems which covers five communities in Harper's district. American Cable Systems and Cablenet have an Interconnect that allows the programming to reach seven additional communities.

Harper provides about twelve hours per day of programming over the educational channel. When they go off the air in the evening, alpha-numeric character-generated bulletin board messages are provided. Programs include telecourses, original productions, and other public or college information programs. Most of Harper's telecourse enrollments are generated from cable or open-air broadcast access.

Harper also has two satellite dishes. If they have a problem downlinking a program, the cable companies will provide back-up service.

**Illinois Central College** plans to have in place by Fall of 1988 a two-way microwave link between Illinois Central College and Bradley University. One component of this link is that Illinois Central and Bradley will do all of the switching for the ITFS connection to the educational channel on the local cable system. An Advisory Board of representatives from Illinois Central, Bradley, and school

districts in the area will decide upon what programming will be transmitted over the educational channel. One of the major sources of programming will be telecourses.

**Lincoln Land Community College** provides telecourse tapes for the I-Net instructional access cable television channel in the Springfield area, which reaches about 50% of Lincoln Land's population base. When no programs are being broadcast, the college provides character-generated information about college activities. The Public School District 186 in Springfield shares this channel, providing educational programming during the day for schools in its district. Sangamon State University also uses I-Net.

**Oakton Community College** has five cable franchises in its district and works directly with two of them. Oakton has a dedicated channel on the Cablenet system over which they feed programs directly from the campus. Cablenet covers about 55-60% of Oakton's district as well as part of Harper College's district. Oakton's Skokie campus feeds programming directly to the TCI cable company in Skokie. TCI covers an additional 10% of Oakton's population.

**Parkland College** is a member of an educational consortium in the Champaign-Urbana area that schedules about 50 hours per week of programming for the Champaign-Urbana cable company's educational access channel. Programs have included school board meetings, athletic events, telecourses, and class projects from Parkland's broadcast curriculum.

Most of the programming provided is telecourses. They are aired in four-hour blocks of time Monday through Thursday and re-broadcast in the evenings. In between broadcast times, character-generated information about college activities is provided. Some additional original programming is provided on occasion.

**Carl Sandburg College** provides limited programming for the local access channel. Tapes of special events are delivered to the cable companies for broadcast. The College is also represented on the Cable Commission in their area.

**South Suburban College of Cook County** (formerly Thornton Community College) has six cable companies in its district. The college has initiated discussion with the cable companies on how best to use the public access channel for programs, public relations, and educational bulletin boards. South Suburban also has an Educational Media internship program which focuses on television

production and script writing. Students from this program are placed at the cable companies in the area for on-the-job experience.

**Triton College** is linked to four cable companies in the district through Triton's ITFS network. The four cable companies cover 52 communities in the greater Chicago metropolitan area and serve a population of 750,000. Telecourses make up a significant portion of the ten hours per day, six days per week of programming.

## Public Libraries

One group of public libraries has formed a cooperative called the **Library Cable Network (LCN)**. When cable franchises began to develop in the northwest suburbs of Chicago about three years ago, they provided channels for library use. Three public libraries--Arlington Heights, Schaumburg, and Indian Trails--later joined by Highland Park, Skokie, and Park Ridge, formed the Library Cable Network (LCN) cooperative to obtain or produce library programming for these channels.

The Library Cable Network received LSCA grants to produce two popular series on Illinois authors. While LCN does some of its own production, most of the 200 hours of programming per month is obtained from other sources such as a series of interviews produced by the Beverly Hills Public Library and senior citizen programming from Baltimore County. The LCN provides programming for four cable companies. Most of the programs are "bicycled", or hand-delivered, to the stations.

The six member libraries pay a membership fee based on their percentage of the population served by the cable companies plus an initial capital cost assessment for equipment of 10 cents per capita.

The main difficulties encountered by the Library Cable Network are ones of transmission: physically delivering the programs to the stations and lacking common times for airing the programs on the various cable stations which necessitates publishing separate program guides for each cable company. Plans for the future are to add libraries to the network.

## Schools

Five years ago, four small high school districts in the Lanark area in west central Illinois with enrollments of 80 to 160 students joined together to lease eight dedicated channels from the local cable company. Their objective was to provide courses for their students which they would not

have been able to provide individually. Because of consolidation, the number of districts participating is now three.

The network is interactive with simultaneous audio and video using multiple monitors. The channels are unscrambled and are open to anyone on the cable system.

A studio is located in each high school, and four monitors are in each studio, one for each of the sites. The teacher is located in the sending studio and can see and hear students in the other three studios. Likewise, students in all locations can see and hear students and the teacher in the other three locations.

The courses offered have changed annually based upon the instructional needs of the members. Over the last five years the network has provided courses in foreign languages, math, physics, chemistry, and shorthand. This distance learning project has worked best in selected advanced classes where the students are older and highly motivated and can work somewhat independently.

The network has just made arrangements to broadcast the Learning Channel's programs to the communities served by the cable company during those times when the channels are not being used by the school network.

**Satellite**

One of the telecommunications technologies gaining acceptance in libraries is satellites. For instance, twenty-five to thirty schools in Illinois now have satellite dishes, and the number is growing. The schools are using satellites for downlinking instructional programs, for teleconferencing, and for communications. At a 1987 fall conference on "Technology for the Rural Schools," different forms of distance learning were identified. At a follow-up meeting supported by the Illinois State Board of Education, the **Illinois STAR Schools Network** was formed. The objectives of the Network are to:

- .Become an information-sharing network for distance learning regardless of the technology
- .Serve in a liaison role
- .Develop a clearinghouse function
- .Provide examples of distance learning in action

The STAR School Network's goal is that any school in Illinois can get information on telecommunications and distance learning by contacting one source. Twenty charter members have already paid $200 each to join the network.

According to the Executive Director, the Network has already begun building a database of information and examples of how the technology is being used today, has developed a mailing list, and will hold a statewide teleconference in October to explain the network. This has been a grassroots effort to provide the kind of information needed by smaller schools.

One of the ways the network sees the state helping the schools is by buying satellite time to uplink hard copy, software, and video programs one-way, and contracting for statewide buys of popular educational programs that could be uplinked. The schools want to use the existing technology, but it must be affordable to fit within today's budgets.

**Community colleges** in Illinois are also rapidly embracing satellite technology for video teleconferencing, instructional programming, and delivery of distance learning in their districts. In a 1988 telephone survey of thirty-one community colleges, twenty-four of them now have or expect to have in the very near future, satellite downlinking capabilities. Twenty-two are providing video teleconferencing and three have access to satellite uplinks.

The American Association of Community and Junior Colleges (AACJC) has asked the Instructional Telecommunications Consortium (ITC) to investigate the possibility of creating a satellite network for community colleges. The PBS Adult Learning Service has established a satellite network for their educational programming. Each of these efforts will have an impact on educational institutions.

**Public Libraries** in Illinois are just beginning to use satellite technology, but many of the needs expressed by public librarians at the focus group sessions involved the use of video technology, of which satellites may be a key provider.

While downlinking capabilities are and need to be widely dispersed throughout the state, **uplinking** capabilities also need to be available but on a more selective basis. Three community colleges, Triton, College of DuPage, and Oakton, have access to uplinks. Triton and Oakton have used them to originate national teleconferences. The Illinois Public Broadcast Council (IPBC) has just received state funds for a mobile, Ku-band satellite uplink which will be available for rental to state agencies and public institutions for uplinking. Western Illinois University is planning on having an uplink in operation by 1989. The University of Illinois and Southern Illinois University at Carbondale are also reportedly discussing uplinking requirements.

## Integrated Networks

### Bradley University

Bradley University is an excellent example of the growing trend on college campuses to centralize information services and integrate voice, video, and data networks.

Two years ago Bradley created the position of Associate Provost for Information Technologies and Resources. This position combined the library, the academic and administrative computer services, the Center for Learning Resources (av, instructional television, public radio station), and the telecommunications unit into one division.

Bradley entered into a partnership with AT&T to totally electronically unify the campus with the intent of bringing computing to the user level using the smallest machine appropriate.

Bradley's main concern was for connectivity of systems already in place which could not communicate with each other. They developed a fiber optic backbone network connecting major academic buildings and placed voice and data outlets at all present telephone locations. They created linking devices to connect the various computers and added a modem pool for off-campus data connectivity.

The library uses the network for electronic mail, word processing, local storage of databases such as InfoTrack and ERIC, as a link to the Resource Sharing Alliance (RSA), for fax, for access to OCLC for interlibrary loans, and for dial access to LCS.

The University is a member of CONVOCOM, serving as a switching station for the consortium. A $3 million television facility is available on campus for classes, production, and satellite downlinking.

According to the Associate Provost, when considering the development of a telecommunications network, there is a need to look at the questions of who are information users, where is the information, and how can they be connected. From one terminal the user should have access to databases, library collections, CD-ROM, electronic mail, graphics, and so forth.

In order for the proposed library network to succeed, the Associate Provost said that it is important that high cooperation be linked to low costs and that an infrastructure be created that makes it work. It should be recognized that the network will probably not reduce costs

substantially but will allow for added capacity at existing costs. The network should be concerned with "first and last mile" access and with developing the potential of video.

Experience at Bradley demonstrates that it is important that a library telecommunications network provide for compatible high speed/high volume data links, multiple connections to databases and other educational networks, access to library networks, high bandwidth capacity for data and video, and teleconferencing capabilities.

**Proposed CMS Network**

Shortly after this LSCA Title III grant was awarded to study the feasibility of a library telecommunications network, NILRC learned that the Department of Central Management Services (CMS) had just completed a similar needs assessment for thirteen government agencies. CMS is the department that provides centralized services for the Illinois state government including the supply of telecommunications, data processing, and office automation.

A consulting firm had surveyed each of the agencies to determine existing and future telecommunications requirements; analyzed the various voice, video, and data network alternatives and made a recommendation for each; analyzed the various options for managing and procuring the network; and developed an implementation plan.

The result was a Strategic Telecommunications Network Plan designed to control communications costs, take advantage of new technologies, and provide better and more cost-effective services. Besides providing for a central control facility, the Plan called for a statewide fiber optic backbone network consisting of high-speed digital transmission facilities between four main switching centers in Chicago, Springfield, Champaign, and Collinsville with four smaller switching centers feeding into these.

Two separate parallel data networks accommodating both SNA and X.25 will be provided. SNA (Systems Network Architecture) is the IBM proprietary communications protocol for communications between various computer systems. X.25 is the new international standard for connecting data terminals to packet switching networks. The voice network will include a transparent uniform numbering plan which will allow for more efficient and economical routing of telephone calls. Only conference grade (CG) video facilities will be provided at compressed T-1 speeds since high resolution or Television Network Quality (TNQ) video requirements were not identified by the state.

Investigations to date indicate that Central Management Services will use T-1 technology between switching nodes and hubs. "T-1" refers to a high bandwidth transmission facility used within the telephone industry since 1961 to interconnect the Central Offices and for the long distance network. Advances in technology have made possible higher transmission rates and increased capacity over these same transmission facilities. By consolidating voice and data requirements with T-1 technology, the end user now has the ability to build a flexible, single, more cost-effective integrated digital network. With the appropriate multiplexors and interface devices, network managers can provide changeable bandwidth or channels for voice, data, and image transmission as required.

While T-1 may be sufficient for voice and data, it remains to be seen if the conference grade video this technology will provide will be adequate for the video needs identified in this study.

CMS will lease the backbone network from Illinois Bell and US Sprint and expects to have the network in place by 1990. In an interview with Network staff, NILRC learned that CMS is willing to work with the library community to provide access to the State's network. While libraries would still need to provide for local access to the nearest node (a substantial portion of ongoing telecommunications costs) the CMS network could be a significant link in the proposed library telecommunications network.

## SELECTED STATEWIDE OR INTEGRATED NETWORKS OUTSIDE ILLINOIS

### State Libraries Survey

Surveys were sent to the State Librarians of 47 states to determine if any statewide, integrated voice, video, and data library or government telecommunications networks were already in place. From the 31 responses, it was clear that integrated networks are not yet widespread, but several states indicated that they were in the conceptual planning stage of developing such a network. Over half of the states responding did have in place non-integrated networks, usually voice or data. The networks were used for facsimile transmission, interlibrary loan, automated circulation/catalog systems, and other data services. Video networks were reported in Kentucky, Mississippi, North Dakota, and Washington.

**INTELENET**

The Indiana Telecommunications Network (INTELENET) is a statewide fiber optic backbone network providing an integrated digital voice and data network for higher education and state government and a separate digital broadcast video network for the Indiana Higher Education Telecommunications System (IHETS).

The initiative for INTELENET came from IHETS which had reached capacity on their microwave video network and needed to expand and improve their voice and video services as well as cope with rising costs of telecommunications. Legislation was passed which created the INTELENET Commission, a separate entity independent of the state government. The Commission is representative of all users and has a paid staff of two, the Executive Director and an Administrative Assistant. The Commission is responsible for budgeting, contract administration, end-user billing, telecommunications planning, user group interaction, and communications consulting services.

INTELENET is a self-supporting organization that collects user fees to cover operating costs. User fees pay for 24 hours per day/seven days per week maintenance including the day-to-day "feeding and caring" of the network.

The problems encountered in the development of the network were political rather than technical. The Executive Director stated that it is important to have customer relationships figured out very early. User agreements should be worked out ahead of time, clearly defining such things as what the system will and will not provide, costs, and so on. The Director said that sometimes an agency can get so caught up in the requirements/procurement process that the political and business concerns become an afterthought. This causes misunderstandings. It is important to keep the consortium and the commission working together.

**IHETS**

The Indiana Higher Education Telecommunication System (IHETS) is a consortium of all the institutions of higher education in Indiana. It was established by the Indiana General Assembly in 1967 and has a line-item appropriation in the Higher Education budget. The IHETS Board of Directors is made up of the Presidents of each of the seven public institutions plus four Presidents representing the private institutions. The IHETS Management Committee is composed of an administrative representative from each member institution and is responsible for operation of the System.

IHETS is reponsive to the telecommunications needs of its members and provides three kinds of service:

-Telephone services - State Universities Voice Network (SUVON)
-Video services (ITFS systems)
-Conference services (ICON)

SUVON links the telephone systems of over ninety campuses so that there is no cost for calls made to those campuses. The IHETS budget pays for the trunks and network switching. The line-item budget subsidy accommodates the fact that all users do not live next door to a concentration point or end node. The campuses pay for tying their switchboards into the main trunks.

The video network uses leased microwave with six switches with single channels to some locations, two to others. IHETS created their own ITFS stations at drops from the leased network.

The IHETS "1990 Plan" calls for added capacity using fiber optics plus ITFS components. The goal for video is to serve at least one site in every county, a goal which they expect to achieve by 1990. With the fiber optic network in place, IHETS will lease two channels, multiplexing one of the two channels. With their use patterns, IHETS needs three channels all the time and a fourth channel just for conferencing.

ICON provides for large conference capability (audioconferencing to twenty different locations) or small-group conferencing. It is used for meetings, conferences, and some instruction.

The consortium is staffed by an Executive Director who is also Dean of Learning Resources at Indiana University, a Director of Business, a Director of Programs, a Director of Systems Operations and Development, technical staff, and support staff.

The Director of Systems Operations and Development likes the consortium arrangement of IHETS with its responsibility to the users. They do <u>not</u> have usage-sensitive contractual arrangements because it is difficult to budget for and hard to control usage.

Problems have to do with the need for centralizing and standardizing the facility and technical arrangements for delivering courses on each of the campuses.

Two problems were discovered as INTELENET was established. The first was that many of the IHETS members did not

understand what INTELENET was. They did not realize INTELENET was not funded by the state but was designed to be self-supporting. The other problem was that no standards are yet accepted for CODEC equipment that connects video locations to the network.

**Maricopa County Community College District (MCCCD)**

The Maricopa County Community College District (MCCCD) includes seven colleges and two educational centers in the Phoenix metropolitan area serving 80,000 credit students. Each college is ten to thirty-five miles apart. Maricopa has installed a microwave network to link each college for data, voice, and video needs. Maricopa initiated a planning process which addressed telecommunications needs in three phases: computers, voice, and video.

The planning process took three years and went from committees to consultants to procurement to installation. The same planning process was used for each phase. The steps involved in the planning process included:

Step I - Needs Assessment The Telecommunications Users Group served as the basic committee. Representatives were hand-picked to get the right mix of decision makers, faculty, media people, and other people with an interest in the technology. The committee became educated about the technology through site visits and attending meetings (vendors were brought in to discuss product availability and cost). The committee created a planning document, scheduled extensive meetings on each campus to explain what planning had taken place and what input was needed, collected information on needs, and refined the strategic plan. The committee then sought reactions to the plan and created an operational plan describing what was to be done, how it would be funded, what hardware was needed, and the steps in the process.

Step II - Bid Specs/RFP/Bid Evaluation Consultants were used in the education process, the needs assessment process, and for the development of the request for proposal (RFP). They helped evaluate the responses to the RFP leading to the procurement of the network.

Step III - Implementation/Installation The final step in the process was the installation of the network and the training of staff in the use of the network.

Each phase took about one year. As each phase progressed, the results were taken back to the people involved to keep them aware of what was happening. According to the Director of Telecommunications, the keys to success were the involvement of all persons affected and having a

financial plan to implement the project. "Once you start, you have to keep the project in front of your constituencies."

**Kirkwood Community College**

Kirkwood Community College is a good example of a hybrid network that provides for the voice, video, and data transmission needs of its district in a variety of ways. The college serves seven counties with a population of about 350,000 and covers over 4,300 square miles.

Grant funds were obtained from the National Telecommunications and Information Administration (NTIA) and from the Fund for the Improvement of Post Secondary Education (FIPSE) to help with the three phases of building the network.

The Kirkwood telecommunications network consists of three components:

Telelink is an interactive, point-to-point, remote microwave network linking the seven outlying classrooms to the main campus in Cedar Rapids.

The ITFS (Instructional Television Fixed Service) network is an omni-directional microwave broadcasting system that covers almost all of Kirkwood's district. The network provides four channels of programming.

The Secondary School Network which is on the air 40-45 hours per week. Twenty high school districts share the channel and the costs.

The Urban Network which is leased to the Cedar Rapids School District.

The BITNet channel, the Business and Industrial Training Network, which offers on-the-job training to small and large businesses in Cedar Rapids.

The Cable channel which interconnects with the commercial cable companies.

In addition to the two microwave systems, Kirkwood has a 36-channel, closed-circuit campus television distribution system. This system connects the central telecommunications master control with the individual classrooms, shops, labs, and the main library of the college as well as a K-12 district south of Kirkwood.

The Kirkwood telecommunications system is managed by a Dean of Telecommunications working with a management team comprised of the Dean as Chair, the Associate Deans from the instructional areas, and the Associate Dean of Community Services.

Recommendations of the Dean for the Illinois grant project were to incorporate fiber optic cable in the plans for any new telecommunications network wherever fiscally and physically possible and to involve institutions and organizations in the project from the beginning. It is difficult to increase their interest and involvement after the fact.

**COMNET**

One integrated voice, video and data network described in the literature was COMNET, a broadband local area network commissioned for the Canadian House of Commons during 1981-1985. The network connects five buildings and has ability to expand to additional buildings. It has a system capacity for "100 discrete full-fidelity audio circuits, the whole range of available off-air, cable, institutional and interactive video services and...electronic mail and data retrieval between a variety of communicating word processors, minicomputers and terminals.... Gateways will connect COMNET to common carriers, other local area networks, and external data bases" (Mazutis and Phillips, 1985, p. 364).

More important than the technology for the purposes of the Illinois grant project is the process that was followed in developing the COMNET network.

The Canadian Broadcasting Corporation served as Project Management. The goal of the project was to "improve the efficiency and speed of communications" (p. 375). The Project Management team found that several information-related activities and analysis projects were already in place in various departments of the government, but no coordination of those efforts into a single plan had taken place.

Project Management first evaluated all the information-related services and activities on a "Good/Bad" matrix to determine strengths and weaknesses, opportunities and "threats", of each. They then tested each service and activity against another matrix to determine which ones would provide the greatest return for the lowest risk. Next followed a thorough needs assessment to determine current and future requirements of prospective users of the telecommunications network.

From these efforts, a set of functional requirements for the network were developed and a sequence for implementation of the network was planned so that each phase would build on the preceding phase.

The philosophy of implementation adopted was one of "voluntary incrementalization." An extensive user support service was established to encourage participation in the network. The capabilities of the new equipment were demonstrated. A support group was established. A telephone hot-line for help with operating problems was provided. Incentives in the form of equipment subsidies were offered. Users who did not wish to search outside databases themselves were able to contact research staff over the network to provide them with expert assistance. The video portion of the network was also used for the actual training and orientation of users.

The organizational structure remained decentralized. The Network Systems Manager serves as the central contact person who routes trouble calls to the appropriate responsible agency. Each existing agency retained responsibility for the components of the network that were in their areas of expertise (Broadcasting Service for audio and video, Electronic Services Branch for maintenance, Computer Systems Branch for outside data service selection and access and for user support services). "The overall result is that COMNET is viewed by staff in those areas as everyone's utility, and not the project of some new elite group" (Desramaux, 1985, p. 378).

The Director of Support and Information Systems stated that the successful implementation of the network could be attributed to careful attention to the "human element," the sense of "ownership" of the network derived from user involvement in each step of the process, and the adoption of a "step-by-step, flexible, evolutionary approach" to the development of the network. (p. 379)

**Colorado**

The Colorado State Library and the Colorado Department of Education commissioned a telecommunications study for Colorado that parallels the Illinois project quite closely. As reported in the literature by Harmon (1986), the purpose of the study was to conduct an analysis of appropriate telecommunications alternatives and identify appropriate telecommunications configurations.

The steps taken included a review of the literature; a survey of Colorado libraries to determine current and anticipated networking activities, telecommunications use, and telecommunications equipment in place; interviews with

directors of existing and proposed networks and telecommunications service providers; a review of existing and anticipated telecommunications technologies; and development of telecommunications scenarios based on analysis of alternatives appropriate to the development of the network.

The final recommendations made included continuing discussions with the state telecommunications department for access to the statewide network (concerns were for access, channel capacity, and adequate transmission speeds), using common carriers for last mile interconnect services connecting primary nodes to the backbone (until the state develops local loop networks at library network node sites or until other access technologies are available that are cost-effective and reliable), and creating an electronic mail network with "800" service access.

Hardware and software recommendations included encouraging libraries to purchase basic electronic networking equipment, monitoring by the Colorado State Library to encourage purchase of equipment compatible with existing and developing networks, and using CD-ROM technologies.

## CONCLUSIONS

There are already a substantial number of library and educational networks in Illinois using telecommunications that are potential users of a statewide library telecommunications network. The technologies used by the networks vary widely from leased phone and data lines to microwave and ITFS to cable to satellite uplinks and downlinks. All of the networks are looking to expand membership and services.

Many of the networks began as grant-funded projects to test the feasibility of the service provided or received grants to expand their services to a wider audience. Some have since become state-supported services. Almost all are multitype, and participation is on a voluntary, cooperative basis with the involvement of the users seen as a key factor in their success. Almost all also charge user fees to support the services.

The integrated voice, video and data networks outside Illinois which were studied can all be described as successfully meeting the telecommunications needs of their constituents. They used various technologies in various combinations, but each was appropriate for the needs addressed.

Each network was careful to involve their constituents in the planning process, provide the necessary user support services, and continually monitor for changing needs and technological solutions.

Each network had an easily identified organizational structure involving a central operating site and user group participation.

Funding for these networks came basically from the state governments' budgets with user fees, where they existed, being assessed on a charge-back basis.

Each of the networks stressed the importance of involving people in the process. As one person said, "If you take care of the people issues, the technological issues will almost take care of themselves."

**SECTION FOUR - TRENDS**

## LIBRARY SERVICES

The literature reflects the growing awareness and interest of librarians for integrating telecommunications into their services. Berry (1986) expressed concern that librarians have neither been able to keep up with the rapidly changing field of information technology nor developed sufficient tools for evaluating the technologies to make crucial decisions. He urged the establishment of an agency to evaluate new technology, disseminate the information, and report on new developments and current applications of the technology in libraries.

L. L. Hill (1985) outlined some of the barriers and benefits of corporate library participation in library networks. Boss (1985) discussed the need for adopting standards for interconnecting health sciences libraries, recommending the Open System Interconnection (OSI) reference model as the most appropriate mechanism. Boss referred to the Linked Systems Project (LSP) as an example of a library network based on the OSI model. The Linked Systems Project allows the Library of Congress, the Research Library Group, the Western Library Network, and OCLC to share and exchange data among their various kinds of computer systems. "While the computer-to-computer link will first be used for the exchange of authority data, it will also encourage the later sharing of full catalog records, location and holdings data, the transmission of interlibrary loan requests, communication with vendors, and other services" (p. 336).

Several successful library networks were described in the literature. Among them were ALANET (Lee, 1986), an electronic information service providing electronic mail and current awareness services as well as gateways to various databases, and the Vermont Automated Libraries System (VALS) ("Vermont", 1985), a statewide information system linking separate but compatible computer systems. VALS provides geographically distributed access to library and information databases from any library, office, or home within the state with access to an appropriately equipped computer terminal.

The Colorado Alliance of Research Libraries (CARL) System (Culkin and Shaw, 1985) is a computer network among Colorado libraries. Octanet (Gadzikowski, 1987) is a computer-based telecommunications network for the delivery of interlibrary loan services, electronic messaging, online union lists, and management reports to the Midcontinental region of the National Library of Medicine's Regional Medical Library network.

The North Carolina Information Network (McGinn, 1987) is an effort on the part of the North Carolina State Library to provide the most up-to-date information possible to all geographic areas of the state. Services provided by the network include a statewide online union catalog and union list of serials, electronic mail/bulletin board system, and telefacsimile for transmission of documents. The Network also provides an in-state toll-free 800 number connecting to the computer service, Tymnet, and Telenet to reduce dial access telecommunications charges.

The Oregon Public Access Catalog (Vennison, 1988) provides access to databases of interest to residents of the state. Several databases have been developed including a statewide newspaper index, a directory of government services, and outside vendor files. Users of the network include the state government, local libraries, the general public, and education.

At a 1987 conference on networking held in California (Nyren, 1985), recommendations for the development of a framework for multitype cooperation in a network were developed. The recommendations included providing for:

- .Equity in governance
- .Voluntary membership
- .Local control
- .New sources of funding
- .Statewide coordination and communication
- .Accommodation with other existing networks and cooperatives
- .Equitable access for all users in all geographic areas
- .Funding for experimentation
- .Incentives for networking
- .Incorporation of established statewide systems
- .Definition of responsibilities for services, determination of fees, procedures, and protocols at state, regional, and local levels
- .Definition of criteria for network membership.

Doucette (1987) pointed out the need to plan for expandability of a network to avoid obsolescence and the need for broadbased involvement of the users of the network in the planning process.

One telecommunications technology that is gaining widespread acceptance in the library community is telefacsimile transmission (fax). In a special report in American Libraries, several fax projects were described. Washington state (Moore, 1988) completed a large-scale, two-year demonstration Materials Delivery Project combining a network of libraries equipped with fax with a statewide ground courier system.

Illinois' facsimile network (Mak, 1988), which links over 150 fax sites, was described from the perspective of a large reference and research center. The College of Physicians of Philadelphia (Aguirre, 1988) developed a fax network for the fast delivery of medical information. A large city/county library in Ohio (Davis, 1988) used fax to communicate with its branch libraries. Montana (Brander, 1988) created the Montana Faxnet Project to demonstrate the use of fax for document retrieval for five sectors: governmental, business, legal, medical, and educational.

Lynch (1986) summarized the importance of libraries becoming involved in the "telecommunications landscape":

> If libraries are to survive as viable services, they must not only understand current computing and telecommunications technologies, but they must develop and execute plans to implement these technologies. This is an issue at all levels: local, state, regional, and national. Doing so will require money, talent, education, creativity, determination, consensus, management, and most of all, vision. (p. 46)

## TELECOMMUNICATIONS TECHNOLOGY

The convergence of telecommunications and technology was frequently cited in the literature as the driving force behind today's telecommunications trends. Goldstein (1988) saw this convergence as both "confusion and opportunity" (p. 36). Noam (1987) described in detail the resulting shift in the concept of public telecommunications from a centralized, hierarchical, universally accessible network (characterized by AT & T before divestiture) to "a new one that is open and loosely interconnected, resembling a federation of subnetworks much like the system prevailing in transportation" (p. 30). The shift toward an information-based service economy has created great user demands for high-speed, low-cost telecommunications at the same time that decentralized services have reduced the former economies of scale and that increased technological options are available.

West (1984) commented on the trend toward distributing powerful information processing capacity to individuals and connected this decentralization to "increasing demand to link this dispersed...power via a digitized, integrated (voice, video, and data) telecommunications network so that individuals can communicate with each other" (p. 2).

The integration of voice, video, and data was one of the primary trends found in the literature. Integration was

discussed on several levels. In 1984, West was calling for colleges and universities to work toward integration of communication technologies on campuses and for coordination and consolidation of management of those technologies to create a "network of networks." Apparently, the academic community agreed with West.

Temple University (Scanlon & Patterson, 1984), the University of Michigan ("University", 1985), Virginia Tech (Blythe, 1986; Lilly, 1985), Cornell (Paul, 1985), Brandeis ("At Brandeis", 1985), Dallas County Community College District (J. R. Hill, 1987/88), and Maricopa County Community College District (Doucette, 1987) all reported merging their communications systems into integrated networks under centralized management.

Integration of voice, video, and data on a global basis in the form of an Integrated Systems Digital Network (ISDN) has been in the development stage for the past fifteen years. The Consultative Committee for International Telegraph and Telephone (CCITT), sponsored by the United Nations, is overseeing the setting of standards for ISDN. Blankenhorn (1986), Harper (1987), Miller (1987), and Underwood (1987) described the development of ISDN and the problems faced in implementing such a global network.

The main problems facing ISDN are lack of agreement on international standards for the technology needed and the high cost of putting the network in place. The world's largest telephone companies are taking the lead in trying to implement ISDN. In the United States, AT & T and the Bell Operating Companies (BOCs) are beginning to replace their central office switches with digital switches, a necessary step in the implementation process. This will be a long and costly process because about 12,000 switches need to be replaced at a cost of $6 million each.

Miller predicted that ISDN will be in place by the mid-1990s. He also predicted that a "proliferation of so called near-ISDNs is...likely to accelerate during the next few years" as systems are designed to take advantage of current technology (p. 37). These systems will be upgradeable to CCITT standards when those standards become available.

ISDN has its critics. Many experts do not expect to see a true single ISDN develop. Rather, they "envision multiple ISDNs intersecting in a variety of ways but with enough uniformity to make services possible that are now impossible" (Miller, p. 38).

Whether or not ISDN becomes a reality, several trends are still evident. Rudd (1987) states that telecommunications networks will be operating at higher data rates and will provide increased connectivity and communication capabilities. The networks will provide widespread access to public data networks. There will be user demand for increased bandwidth. The costs of electronics and basic transmission will decrease, but the new complexity of the networks will require more skilled personnel to manage and support the networks. Noam (1987) points out that transmission facilities will continue to change from analog to digital technology.

One digital transmission facility expected to play a key role for the next several years is fiber optics (Rocher, 1987). Fiber optics consists of thin strands of fiber made of transparent material such as glass or plastic through which light pulses are transmitted. Each strand is capable of carrying the equivalent of 6,000 voice messages at one time.

The signals are not susceptible to electrical noise, lightning, or other forms of electromagnetic interference, and are impervious to temperature or moisture. Fiber optics technology provides high bandwidth, low signal loss, and security advantages (Ohlraber, 1987). Telephone companies are moving to install fiber optic networks in the United States (McCourt & Robinson, 1986). As Welter (1987) states, fiber is becoming "the medium of the future for most point-to-point long-distance voice and data communications" (p. 50).

According to Trafton (1987), another trend in technology is that "data, text and video are filling an even greater share of the communication applications" (p. 38). Satellite technology is playing a significant role in serving those applications. Gershon (1987) anticipates that satellites "will become the primary vehicle for video communications, point-to-multipoint communications and thin-route applications" (p. 25). Welter adds that "the appeal of bypassing the public switch network, ease of installation, and distance-independence often make satellites the economical choice for communication in remote areas" (p. 50).

Satellites are particularly good for reaching remote or scattered locations where it is not economical to build fiber networks. Satellites have proved to be useful in library and education settings for providing video teleconferencing and for delivery of distance learning (Brumm, 1984; Portway, 1987; "Teleconferencing", 1987-88; Wolf, 1987).

According to Welter, the introduction of VSATs (Very Small Aperture Terminals) has considerably reduced data communications costs via satellite when compared to costs for leased telephone lines for networks with widely dispersed locations.

The advantages and disadvantages of fiber optics and satellite networks were thoroughly discussed in the literature. However, there was general agreement that there is a place for both. In fact, a hybrid network designed to take advantage of the strengths of not only fiber optics and satellites but microwave and cable and other existing transmission methods as well was proposed (Castiel, 1985; Pelton & McDonegal, 1987; Stephens, 1986; Welter, 1987). According to Pelton, "There is a growing realization...that the issue is not satellite vs. terrestrial transmission media, but rather how best to combine satellites and terrestrial transmission media in a dynamic and optimally-designed ISDN network" (p. 62).

## CONCLUSIONS

More telecommunications services will be available to libraries and more libraries will take advantage of those services. Telecommunications will promote greater resource sharing and more networking among libraries. Librarians and patrons will increase their computer and telecommunications literacy. Patrons will increasingly become the end-users of many telecommunications network services.

Transmission of full-text documents will become the norm as data speeds increase and telecommunications costs decrease. New storage and delivery capabilities will be available to increase library services.

The convergence of telecommunications and technology will result in greater decentralization of information processing capacity. The possibility now exists of integrating voice, video, and data transmission networks. Telecommunications networks will provide higher speeds and increased bandwidth capacity through the conversion of analog to digital transmission.

Fiber optics and satellite technologies will be key components in telecommunications networks.

While these trends in technology offer exciting possibilities for libraries, it must be remembered that technology itself is but the means to an end. Kooser (1987) said it well:

The key concept to keep in mind when planning for new technology is that the development of an information system is a strategic decision, not a technological one. It should rely on the organization's goals and basic methods of operation, rather than on what's new in the marketplace. (p. 66).

## SECTION FIVE - FUNCTIONAL DESIGN CRITERIA

### FUNCTIONAL DESIGN REQUIREMENTS

#### Purpose and Functions of the Illinois Libraries Telecommunications Network

There is no statewide library telecommunications network in Illinois, yet there is mounting evidence of the need for such a network. In the December 1987 Final Report of the Blue Ribbon Task Force on the Illinois Library Systems Study, the HBW Associates' recommendation that a statewide automation plan be developed was accepted without qualification.

In the 1988 revised draft of the Plan for Funding Automated Resource Sharing in Illinois Libraries, the need for "better coordination...to provide cost-effective telecommunications as the pathway to information" was addressed. Telecommunications costs were seen as a "major barrier to effective resource sharing" (p. 29). The Committee recommended that a statewide state-of-the-art telecommunications network providing cost-effective voice, video, and data transmissions be created to link libraries in Illinois.

At their May 1988 meeting, the Illinois State Library Advisory Committee endorsed the Library of Congress Network Advisory Committee's statement on a "common vision" for library networking. This statement recognizes that diversity in providing library services will continue to dominate, but that libraries of all types must work together to provide each individual with equal opportunity of access to resources. "As this vision becomes reality, there will emerge a diverse but coordinated structure of networks...an interlocking series of local, state, regional, national, and international relationships that are capable of serving the nation's information needs."

The increasingly widespread use of teleconferencing in Illinois community colleges, with over half of the colleges planning to have satellite downlinks by 1990; the expansion of telefacsimile transmission into libraries of all types; the proliferation of automation systems and information databases; and the bewildering array of telecommunications options now available all point to the need for a statewide telecommunications initiative.

An Illinois library telecommunications network would provide for library needs in several ways. It would serve ILLINET libraries by:

- Dealing with statewide library telecommunications issues
- Acting as a telecommunications facilitator for member libraries
- Providing a communication link between libraries
- Determining what telecommunication services should be made available
- Establishing standards and protocols for use of the network
- Seeking out and promoting new services
- Ensuring the most economical statewide telecommunications service
- Coordinating voice, data and video transmission services for ILLINET libraries.

**Functional Design Requirements**

Based on the results of the focus group sessions, the following requirements for the library telecommunication network were developed:

- The network must be a flexible system that allows for the expansion and implementation of new technologies as they develop. For example, it should have the capacity for:
  - the transmission of high resolution graphics, such as schematics and detailed drawings
  - two-way transmission of high-quality video signals
  - provision of fast, faithful transfer and receipt of documents
  - access to new databases such as career guidance and job information.

- The network should provide easy access to different databases, both state-wide and nationally, through transparent interconnections (gateways) between networks.

- The network should interface with existing common carriers (e.g. AT&T, Sprint, MCI, Illinois Bell, Western Union, local cable companies) in such ways as to permit the home connection by library patrons utilizing many different devices, including telephone, television, and personal computers.

- The network should include the capability of expansion to include the cost-effective development of professional staff and in-service training, distance learning, teleconferencing, and continuing education.

The telecommunications network as it is designed should address several significant goals:

- Access to the network should allow for improved resource sharing between and among users.

- The network should permit full subscriber participation in network development, operation, management, and maintenance.

- The network should be cost-effective for all users.

- The availability of a library telecommunications network should encourage cooperative collection management between and among libraries.

- The availability of a telecommunications network should enhance communications among institutions throughout the state; for example, between libraries, or as a reporting mechanism between libraries and state agencies.

**Network Strategies**

The Statewide Advisory Committee used the functional design requirements developed from the focus group sessions and the information provided from the interviews as the basis for their strategic planning session held near the end of the grant cycle. During that session, the Advisory Committee discussed why a library telecommunications network is needed, the population to be served, the scope of the network, where Illinois libraries are today in terms of their use of telecommunications, where libraries will be

in five-to-ten years. The Committee then prepared some basic strategic statements to define the purpose and role of a library telecommunications network.

The leadership structure developed to manage the network was seen as a coordinating body to establish statewide services and the means for carrying them out.

The use of the network would create services that would be offered throughout the state and help users in various locations interface with those services. The network management structure would also make general decisions as to which services were offered, based on information from libraries pertaining to their service needs, and then communicate and negotiate with vendors to meet those needs.

Four primary strategies were developed:

- **Find and promote less costly telecommunication services**
- **Promote increased use of telecommunication services from all sources (libraries, homes, offices)**
- **Establish a monitoring function to translate telecommunications/automation developments into practical library applications**
- **Develop telecommunications user support services.**

## SECTION SIX - ALTERNATIVES AND RECOMMENDATIONS

### ALTERNATIVES

Libraries in Illinois are faced with several alternatives for meeting their telecommunications needs for the next five-to-ten years.

- **No Action**

  One option always available is to take no action. This would leave libraries with no coordinated statewide strategy to enhance cooperation and the sharing of resources that were cited in the focus groups as requirements for library services.

- **Independent Action**

  Libraries in homogenous groups or as individual institutions can continue to independently pursue telecommunications options as they are now so doing. This results in repeated duplication of efforts, the creation of non-compatible systems, and defeats the stated goals of cooperation, connectivity, and cost-effectiveness.

- **Autonomous Library Network**

  A third option is for libraries in Illinois to build an autonomous network for their use. It was the conclusion of the Statewide Advisory Committee that this option is neither economically feasible nor politically responsible or desirable.

- **Statewide Library Network Using Existing State Capabilities**

  A fourth option, and the one that is recommended, is that a statewide library telecommunications network be developed that builds upon existing and proposed telecommunications capabilities within the state. This option should prove to be the most cost-effective choice, creating a communication "pathway" which would allow for the enhancement of cooperative resource sharing, the expansion of library services, the provision of a pipeline for interfacing various computer systems, the reduction of delivery time of information to patrons, and the increase of staff development and continuing education opportunities.

## RECOMMENDATIONS

**An Illinois statewide library telecommunications system should be developed that interconnects to existing and proposed networks throughout Illinois and which utilizes the several technologies and services available.** (For description of possible interconnections, see Appendix F)

**There should be at least one switching node in every library system to link the libraries of all types within those geographic areas.**

**Interconnection to the proposed Central Management Services network should be investigated. (See Maps in Appendix F)**

## MANAGEMENT ACTION PLAN

In order to implement the recommendation to develop an Illinois library telecommunications network, there are responsibilities that need to be assumed by the Illinois State Library and by NILRC.

### Illinois State Library Responsibilities

- **Appoint a Task Force**

  The task force appointed by the Illinois State Library should be charged with the responsibility of designing the appropriate leadership structure necessary to assure the continuation and support of the statewide telecommunications initiative. Several models for such a structure were identified earlier in this report in the section on "Current Library and Education Telecommunications Environment."

  The Task Force should be made up of seven members representing the Illinois State Library, NILRC, Central Management Services, Library Systems, academic institutions, and two members at large from the library community.

- **Utilize Established Human Resources Network**

  The human resources network developed during Phase I of this grant should continue to be used as a sounding board for the further development of the telecommunications network. Particularly helpful would be the past advisory committees, the focus group facilitators and participants, and the NILRC members and staff.

- **Establish the Leadership Structure**

  The leadership structure recommended by the Task Force should be put in place in order to provide the coordination, leadership, and management necessary for the development of the network. The role of the leadership structure should include, but not be limited to:

  - .Promoting less expensive telecommunications through pooling of resources
  - .Providing simplified packaging of solutions to telecommunications problems that exist
  - .Developing standards and practices for interconnectivity to the network
  - .Developing user support services to assure usability of the system, including training, documentation, technical support, and a "help line"
  - .Providing incentives for participation (subsidy, shared costs, and so on)
  - .Negotiating with vendors for additional services on behalf of all ILLINET libraries
  - .Serving as an information clearinghouse on telecommunications options for libraries
  - .Exploring funding options for the development and continuation of the network.

- **Distribute the Report**

  This grant report should be widely distributed in the Illinois library community to increase awareness of libraries in the state of the planning and development of the library telecommunications network. The advisory committee members, the library systems, the NILRC members, the Illinois State Library Advisory Committee, the Illinois Community College Board, the Illinois Board of Higher Education, the focus group facilitators and participants, and other relevant groups and agencies should particularly find the report of interest.

- **Develop Liaison with Central Management Services (CMS)**

  It is important for the development of the library telecommunications network that the Illinois State Library increase its participation in the development of Central Management Services' proposed statewide fiber optic backbone network.

**Northern Illinois Learning Resources Cooperative (NILRC) Responsibilities**

Because the Cooperative has received approval for LSCA Title III grant funding for the second year of the project, NILRC will:

- **Maintain Liaison with Central Management Services**

  Such a liaison is necessary to assure that the needs of Illinois libraries are included in Central Management Services' telecommunications network plan.

- **Develop Technical Needs Statements**

  An engineering study will be conducted for selected library systems in Illinois which will define the technical requirements for connecting library systems to the proposed CMS high-speed digital backbone telecommunications network.

- **Provide Leadership for Information Exchange**

  It is important to maintain liaisons with the Illinois State Library, the Automation Committee, other appropriate committees and governmental agencies, and the library community to encourage participation in the planning and development process.

- **Further Explore Funding Options**

  Funding possibilities for the development of the library telecommunications network will be further explored.

## PROJECTED TARGET DATES

### FY 1989

- **Task Force Appointed**
  - .Study telecommunications network leadership options
  - .Discuss recommended options with human resources network established in Phase I
  - .Make recommendations on leadership structure to the Illinois State Library by March 31, 1989

- **Technical Needs Statements Developed**
  - .Submit statements to the Illinois State Library by December 30, 1988

- **Engineering Report for Selected Library Systems**
  - .Complete and submit to the Illinois State Library by June 30, 1989

### FY 1990

- **Telecommunications Network Leadership Established**
  - .Management structure in place by July 31, 1989

- **Components of the Network Developed**
  - .Task Force to assist network management in development of components of the network appointed by July 31, 1989
  - .Standards for connectivity developed by March 31, 1990
  - .User support services planned by March 31, 1990
  - .Possible vendors identified by March 31, 1990
  - .Funding options identified by March 31, 1990

- **Illinois Library Telecommunications Network Operational Plan Developed**
  - .Network management and Task Force develop plan based on network components listed above.
  - .Submit plan to Illinois State Library Advisory Committee by May 1, 1990.

- **Engineering Report for Remaining Systems Completed**
  - .Complete and submit to Illinois State Library and the network management by June 30, 1990

- **Telecommunications Information Clearinghouse Created**
  - .Database and method of access in place by June 30, 1990

### FY 1991

- **Implementation of the Library Telecommunications Network**
  - .Ongoing

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## APPENDIX A

### Project Staff, Fiscal Year 1988

**Office Staff - Northern Illinois Learning Resources Cooperative**

Alice Calabrese, Project Director

Linda Bigelow, Project Consultant

Sandra Jones-Warren, Project Coordinator
August 17, 1987 - January 15, 1988

Margaret Lumbert, Project Secretary

**Consultants**

Richard Calabrese - Ph.D.
Human Communications Consultant

Richard Gall - Communications Technologies, Inc.

Ellen Dick - M.L.S., M.B.A.
Specialist in Foundations Research

James Davis, Gerald Johnson - The Omni Group

### Committees

**Local Advisory Committee**

Alice Calabrese, Project Director
Northern Illinois Learning Resources Cooperative
Sugar Grove

Joseph Chambers, Associate Dean
Media and Telecommunications
Triton College - River Grove

Donald Drake, Audio-Visual Director
College of Lake County - Grayslake

Pamela Gaitskill, Learning Resource Center Director
Prairie State College - Chicago Heights

Michael Madden, Director
Schaumburg Township Public Library - Schaumburg

Vicky Smith, Executive Dean (7-1-88 to 12-31-88)
Moraine Valley Community College - Palos Hills

Nancy Young, Learning Media Center Coordinator
Gordon Gregory Middle School - Naperville

## APPENDIX A

## Committees

### Statewide Advisory Committee

Linda Bigelow
Project Consultant - St. Louis

Kathleen L. Bloomberg
Associate Director for Library Development
Illinois State Library - Springfield

Alice Calabrese, Project Director
Northern Illinois Learning Resources Cooperative -
Executive Director - Sugar Grove

Joseph Chambers
Associate Dean of Media and Telecommunications
Triton College - River Grove

Delinda Chapman, Director
Data Processing Department
Office of the Illinois Secretary of State
Springield

Christine Frank
Associate Director for Information Services
Rush University Library - Chicago

Lloyd Gentry, Learning Resource Center and
Telecourse Director
Belleville Area College - Belleville

Dale Guthrie, Media Center Director
Salem High School - Salem

Linda Hanrath, Corporate Librarian
W. M. Wrigley, Jr. Co. - Chicago

Joel Hartman, Associate Provost
Information Technologies and Resources
Bradley University - Peoria

Elizabeth Huntoon, Coordinator of Children's Services
Chicago Public Library - Chicago

William Lindgren, Learning Resource Center Director
Illinois Central College - East Peoria

Robert McKay, Director
River Bend Library System - Coal Valley

## APPENDIX A

## Committees

### Statewide Advisory Committee
(Continued)

Jack McManus, Assistant Vice President, AISS
University of Illinois - Champaign

Michael Madden, Director
Schaumburg Township Public Library - Schaumburg

Robert Wallhaus, Deputy Director
Illinois Board of Higher Education - Springfield

Janet York, Statewide Network Project Manager
Central Management Services - Springfield

Nancy Young, Learning Media Center Coordinator
Gordon Gregory Middle School - Naperville

### Personnel Selection Committee

| | |
|---|---|
| Joseph Barillari | College of DuPage - Glen Ellyn |
| Kathleen L. Bloomberg | Illinois State Library - Springield |
| Alice Calabrese | Northern Illinois Learning Resources Cooperative - Sugar Grove |
| Joseph Chambers | Triton College - River Grove |
| Steven Crady | Illinois Central College - East Peoria |
| Pamela Gaitskill | Prairie State College - Chicago Heights |
| Michael Madden | Schaumburg Twp. Public Library - Schaumburg |
| Vicky Smith | Moraine Valley Community College - Palos Hills |

## APPENDIX A

**Grants Committee**

| | |
|---|---|
| Alice Calabrese | Northern Illinois Learning Resources Cooperative - Sugar Grove |
| Joseph Chambers | Triton College - River Grove |
| Janet Dellaria | Kishwaukee College - Malta |
| Bernard Fradkin | College of DuPage - Glen Ellyn |
| Pamela Gaitskill | Prairie State College - Chicago Heights |
| Jack Weiss | Elgin Community College - Elgin |

## APPENDIX B

### Focus Group Participants

**Region 1**

Facilitator: Donald Drake, AV Director
College of Lake County

Meeting Place: College of Lake County - Grayslake

Participants:

| | |
|---|---|
| Carla Funk | American Medical Association |
| Marilyn Lester | National College of Education |
| Robert McClarren | North Suburban Library System |
| Ulo Ormiste | Chicago Public Library |
| Ines Ringland | Rosary College Library |
| Alice Scott | Chicago Public Library |
| Kenneth Swanson | Indian Trails Public Library |
| George Voegel | William Rainey Harper College |
| Claudette Warner | Sears Roebuck Corporation |

**Region 2**

Facilitator: Joseph Chambers Associate Dean
Media and Telecommunications
Triton College

Meeting Place: College of DuPage - Glen Ellyn

Participants:

| | |
|---|---|
| Pat Dewey | Maywood Public Library |
| Bernie Fradkin | College of DuPage |
| Diane Grund | Moraine Valley Community College |
| Peter McElhinney | Bur Oak Library System |
| Betty McKinley | DuPage Library System |
| Edward Meachen | North Central College |
| Barbara Meyers | Steger-South, Chicago Heights Library District |
| Camille Stryck | Amoco Corporation Central Research Library. |
| Katie Votek | Glenside Public Library |

**APPENDIX B**

**Focus Group Participants**
(continued)

**Region 3**

Facilitator: Eric Welch, Director
Learning Resources
Highland Community College

Meeting Place: Highland Community College - Freeport

Participants:

| | |
|---|---|
| Carol Bird | Peru Public Library |
| Caryl Brasile | Matson Public Library |
| Nancy Dale | St. Anthony Medical Center |
| Diane Fagen | Rockford Memorial Hospital School of Nursing Library |
| John Locascio | Freeport Public Library |
| Martha Mattingly | Pearl City School Libraries |
| Gerry McElroy | Northern Illinois Library System |
| James Michna | Howard Colman Library |
| John Raney | Highland Community College |
| Joel Rosenfeld | Rockford Public Library |
| Mary Schneider | Microswitch Resource Center |
| Peggy Sullivan | Northern Illinois University |
| Tom Wallmo | Northern Illinois Library System |

**Region 4**

Facilitator: Steve Crady, Assistant Director, LRC
Illinois Central College

Meeting Place: Illinois Central College - East Peoria

Participants:

| | |
|---|---|
| Roy Chang | Western Illinois University |
| Cheryl Culbertson | Western Illinois Library System |
| Margareth Gibbs | Peoria Public Library |
| Charles Hale | Millikin University |
| Paul Johnson | Rolling Prairie Library System |
| Denise Kaplan | Lincoln Library |
| Sherwood Kirk | Illinois Valley Library System |
| Barbara McNally | Resource Sharing Alliance |
| Joan Roeder | East Peoria School District #86 |
| Margaret Stefanak | Lewis & Clark Library System |
| Susan Stroyan | Illinois Valley Library System |
| Travis Tyer | Great River Library System |
| Valerie Wilford | Illinois Valley Library System |
| Jean Wilkens | ILLINET/OCLC |
| Randy Wilson | Parlin-Ingersol Public Library |
| Dave Woodward | Washington Community High School |

**APPENDIX B**

**Focus Group Participants**
(continued)

**Region 5**

Facilitator: David Johnson, LRC Director
Parkland College

Meeting Place: Parkland College - Champaign

Participants:

| | |
|---|---|
| Jim Bradford | Milner Library |
| David Bishop | University of Illinois Library |
| Susan Chou | Rantoul Public Library |
| Leigh Estabrook | University of Illinois |
| Donna Goehnor | Milner Library |
| Jan Ison | Lincoln Trail Library System |
| Fred Schlipf | Urbana Free Library |
| Bernard Sloan | University of Illinois |
| Robert Wegman | Normal Public Library |

**Region 6**

Facilitator: Carl Cottingham, Dean of Learning Resources
John A. Logan College

Meeting Place: Rend Lake College - Ina

Participants:

| | |
|---|---|
| Robert Ensley | Kaskaskia Library System |
| Joe Harris | Cumberland Trail Library System |
| Gerry Hermann | Belleville Public Library |
| Candy Isberner | Southern Illinois University |
| Joyce Kelly | Carbondale Community High School |
| Juanita Martin | Lincoln Trail College |
| David Patton | Rend Lake College |
| Debbie Rodgers | Shawnee Library System |
| W. J. vanGrunsven | State Community College |
| Shirley Wakefield | Robinson Township Library |
| Dan Yahne | Harrisburg School District |

**APPENDIX B**

**Focus Group Participants**
(continued)

**Region 7**

Facilitator: Linda Bigelow, Project Consultant
NILRC

Meeting Place: River Bend Library System - Coal Valley

Participants:

| | |
|---|---|
| John Caldwell | Augustana College Library |
| Rose Chenoweth | Moline Public Library |
| Tom Moran | Davenport Public Library |
| Mary Root | River Bend Library System |
| Bill Schaumberg | River Bend Library System |
| Mary Anne Stewart | River Bend Library System |
| Laura Walker | East Moline Public Library |

## APPENDIX C

### Presentations

Presentations about the grant project were made to individuals and groups as listed below:

**Conferences**

- .Illinois Council of Community College Administrators-Peoria
- .Triple I Conference - Oakbrook
- .NILRC National LRC Conference - Grayslake
- .State Agency Librarians Annual Meeting - Springfield

**Library Systems**

- .Bur Oak Library System - Shorewood
- .Cumberland Trail Library System - Flora
- .DuPage Library System - Geneva
- .Great River Library System - Quincy
- .Illinois Valley Library System - Pekin
- .Kaskaskia Library System - Smithton
- .Lincoln Trail Library System - Champaign
- .North Suburban Library System - Wheeling
- .Northern Illinois Library System - Rockford
- .River Bend Library System - Coal Valley
- .Rolling Prairie Library System - Decatur
- .Suburban Library System - Hinsdale
- .Western Illinois Library System - Galesburg

**Seven Focus Group Sessions**

**Illinois Community College Board**

- .David Pierce, Executive Director
- .Ivan Lach, Deputy Director for Programs
- .Yvonne Singley, Director of Academic Programs
- .Lynn Burger, Director of Economic Development

## APPENDIX D

## Foundations

### Local Foundations Which May be Approached for Funding a Telecommunications Network

Ameritech Foundation
30 South Wacker Drive, 34th Floor
Chicago, Il 60603
750-5223
Michael E. Kuhlin, Executive Director

AMOCO Foundation, Inc.
200 East Randolph Drive
Chicago, Il 60601
856-6306
Bob Arganbright, Executive Director

Borg-Warner Foundation
South Michigan Ave.
(Chicago, Il 60601
322-8657
Ellen J. Benjamin, Director
Corporate Contributions

Chicago Community Trust
222 N. LaSalle, Suite 1400
Chicago, Il 60601
372-3356
Bruce Newman, Executive Director

Field Foundation of Illinois
135 South LaSalle
Chicago, Il 60603
263-3211
Lindsey Handy, Executive Director

Gould, Inc. Foundation
10 Gould Center
Rolling Meadows, Il 60008
640-4059
Jan Britt, Director

IBM Corporation
One IBM Plaza
Chicago, Il 60611
245-6559
Lee Curtis, Community Relations Manager

## APPENDIX D

**Local Foundations**
(continued)

Illinois Bell Telephone
225 West Randolph HQ 19D
Chicago, Il 60606
727-3000
John O. Gardner, Manager, Corporate Contributions

The Joyce Foundation
135 South LaSalle, Suite 4010
Chicago, Il 60603
782-2464
Craig Kennedy, President

John D. & Catherine T. MacArthur Foundation
140 South Dearborn
Chicago, Il 60603
726-8000
Rebecca Riley, Director, Special Grants Program

Regenstein Foundation
3450 North Kimball Avenue
Chicago, Il 60618
463-4355
Director

Santa Fe Southern Pacific
224 South Michigan Avenue
Chicago, Il 60604-2401
786-6204
George D. Scheckel, Executive Director

Square D Company
Executive Plaza
Palatine, Il 60067
397-2600
Roger A. Sackett, Vice President, Public Affairs

Wallace Computer Services Foundation
4600 West Roosevelt Road
Hillside, Il 60162
449-8600
Len Hauskey, Secretary

Zenith Electronics Corporation
1000 Milwaukee Avenue
Glenview, Il 60025
391-8181
John I. Taylor, Director, Corporate Public Relations

## APPENDIX D

**National Foundations Which May be Approached for Future Funding of a Library Telecommunications Network**

Atlantic Richfield Foundation
515 South Flower St.
Los Angeles, CA 90071
213-486-3342
Eugene R. Wilson, President

Benton Foundation
1776 K Street, N.W., Suite 900
Washington, D.C. 20006
202-429-7350
Carolyn F. Sachs, Executive Director

Carnegie Corporation of New York
437 Madison Ave.
New York, N.Y. 10022
212-371-3200
Sara L. Engelhardt, Secretary

The Ford Foundation
320 East 43rd St.
New York, N.Y. 10017
212-573-5000
Barron M. Tenny, Secretary

Charles H. Revson Foundation
444 Madison Avenue
New York, N.Y. 10022
212-935-3340
Eli N. Evans, President

## APPENDIX E

### Interview Questions for Site Visits

1. What is the need that this network addresses?
2. What kind of network is it (technology, components)?
3. What is the organizational or governance structure of the network?
4. How was the network established and funded?
5. How is the network used?
6. What were/are the problems with the network (what would be done differently)?
7. What are the plans for the future of the network?
8. Do any libraries (public, academic, school, special) use the network? If so, in what ways?

## APPENDIX E

### Interviews Conducted for Networks Described in Report

Jan Baltzer
Director of Telecommunications
Maricopa County Community Colleges District

Lynn Blakesley
Associate Dean of LRC and Instructional Technology
Waubonsee Community College

Ronald Bleed
Director of Information Technologies
Maricopa County Community Colleges District

Kathy Bloomberg
Associate Director for Library Development Group
Illinois State Library

Robert Burton
Department Chair, AV Services
Oakton Community College

Joseph Chambers
Associate Dean of Media and Telecommunications
Triton College

Sharon Clark, Assistant Director for Automated Services
ILLINET Online
University of Illinois

Michael Connet, Coordinator
Kirkwood Telecommunications Systems
Kirkwood Community College

Stephen Crady
Assistant Director of LRC and AV Director
Illinois Central College

Donald Drake
AV Director
College of Lake County

Al Dunikoski
Dean of Learning Resources
William Rainey Harper College

Bernard Fradkin
Dean of LRC
College of DuPage

## APPENDIX E

**Interviews Conducted for Networks Described in Report**
(continued)

Richard Gross
Dean of Telecommunications
Kirkwood Community College

Gerald Gruebel
President
CONVOCOM/Intelligent-Vision

Joel Hartman, Associate Provost
Information Technologies and Resources
Bradley University

Thomas Ho
Executive Director
INTELENET Commission

Jim Jackson
Media Specialist
Lincoln Land Community College

David Johnson
Director of Learning Resources
Parkland College

Sherwood Kirk
Director
Western Illinois Library System
Galesburg, IL

William Lindgren
LRC Director
Illinois Central College

Doris Lusinski, Coordinator
Audiovisual Department
South Suburban Community College of Cook County

Joel McFadden
Superintendent of Schools
Lanark, Illinois

Barbara McNally
Executive Director
Resource Sharing Alliance (RSA) of West Central Illinois

Michael Madden, Director
Schaumburg Township Public Library

## APPENDIX E

**Interviews Conducted for Networks Described in Report**
(continued)

Charles Miller, Division Chief
Communication Services Division
Central Management Services

Jill Miller
Director of Learning Resource Center
Kirkwood Community College

Mary Anne Parr
Director of the Medical Library
St. Francis Medical Center - Peoria

James Pletz, Director
Illinois Regional Library for the
Blind and Physically Handicapped

James Potter
Director of Systems Operations and Development
Indiana Higher Education Telecommunication System (IHETS)

John Putz
Director of Media Services
Elgin Community College

Jane Regnier
Telecommunications System Coordinator
Waubonsee Community College

Suzanne Schriar, Coordinator
OCLC/SILO
Illinois State Library

Martin Siegel
Assistant Director
NovaNET (PLATO)

Bernard Sloan, Manager
Library System User Services
ILLINET Online (LCS/FBR)

Patrick Stout
Associate Director for Television
Western Illinois University

Frederick Visel
Assistant Dean, Learning Resources Services
Carl Sandburg College

## APPENDIX E

**Interviews Conducted for Networks Described in Report**
(continued)

Jean Wilkins, Director
ILLINET/OCLC Services
Illinois State Library

David Woodward, Executive Director
Illinois STAR Schools Network

Janet York
Statewide Network Project Manager
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# APPENDIX F

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for

LSCA TITLE III Grant Proposal

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## APPENDIX F

## CMS FIBER NETWORK

The proposed CMS Fiber Network will provide some of the long haul transmission requirements if sufficient bandwidth is allocated for library use. The network has obvious value in providing information transmission between major population centers but even in those areas, the "last mile" problem requires solution.

As the map indicates, the match between Library Systems and CMS Fiber Network nodes is not very good. For example, Normal may be on the Chicago/Springfield route but does not have a node. Approximately half of the Library Systems are not geographically close to fiber network nodes.

The CMS Fiber Network should certainly be part of the library network planning but the extent of its usefulness cannot be gauged until we know more about its exact implementation details. Some of the factors depend on vendor selection and include exact node locations along with present and future bandwidth capabilities.

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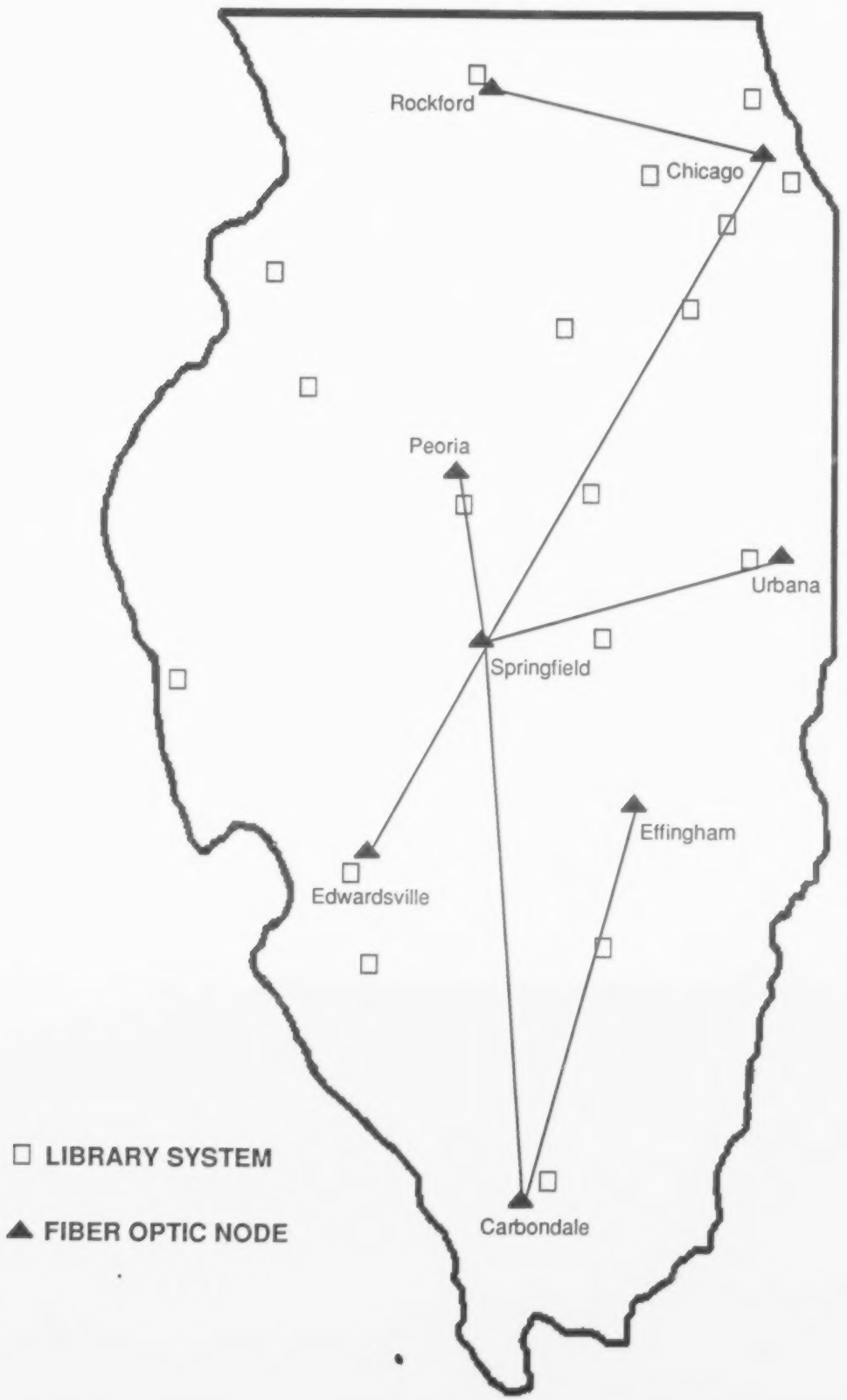
# CMS FIBER OPTIC NETWORK



## APPENDIX F

## CENTEL VIDEOPATH

The Centel Videopath network provides microwave service in the greater Chicago area. Full motion video, data, and voice may be carried between any two points in the area.

The original Videopath concept was to provide video interconnect service to all Chicago area cable television systems. The scope of the network has since evolved to include transmission services for the television networks, video teleconferencing, and data transmission. Both permanent and temporary transmission services are available.

Videopath has its Network Control Center at McCook, lllinois. Switching Centers are located at Wheaton, Blue Island, and Park Ridge.

Satellite downlink and uplink services on both C and Ku bands are available through the network.

The Videopath network is extremely useful for providing telecommunications services in Chicago because it has existing or future tentacles in almost every part of the metropolitan area. Theoretically the network can be extended through the interconnected cable television systems and therefore cover any location passed by CATV.

Centel Videopath can:

1. Perhaps provide the best interconnection among Chicago area Library Systems. The network will carry full motion, color, bi-directional video plus data and voice into almost any Chicago area location on a permanent or temporary basis.

2. Uplink and downlink services are easily available for switching to and from any point on the network. This provides statewide, interstate, and worldwide interconnection possibilities.

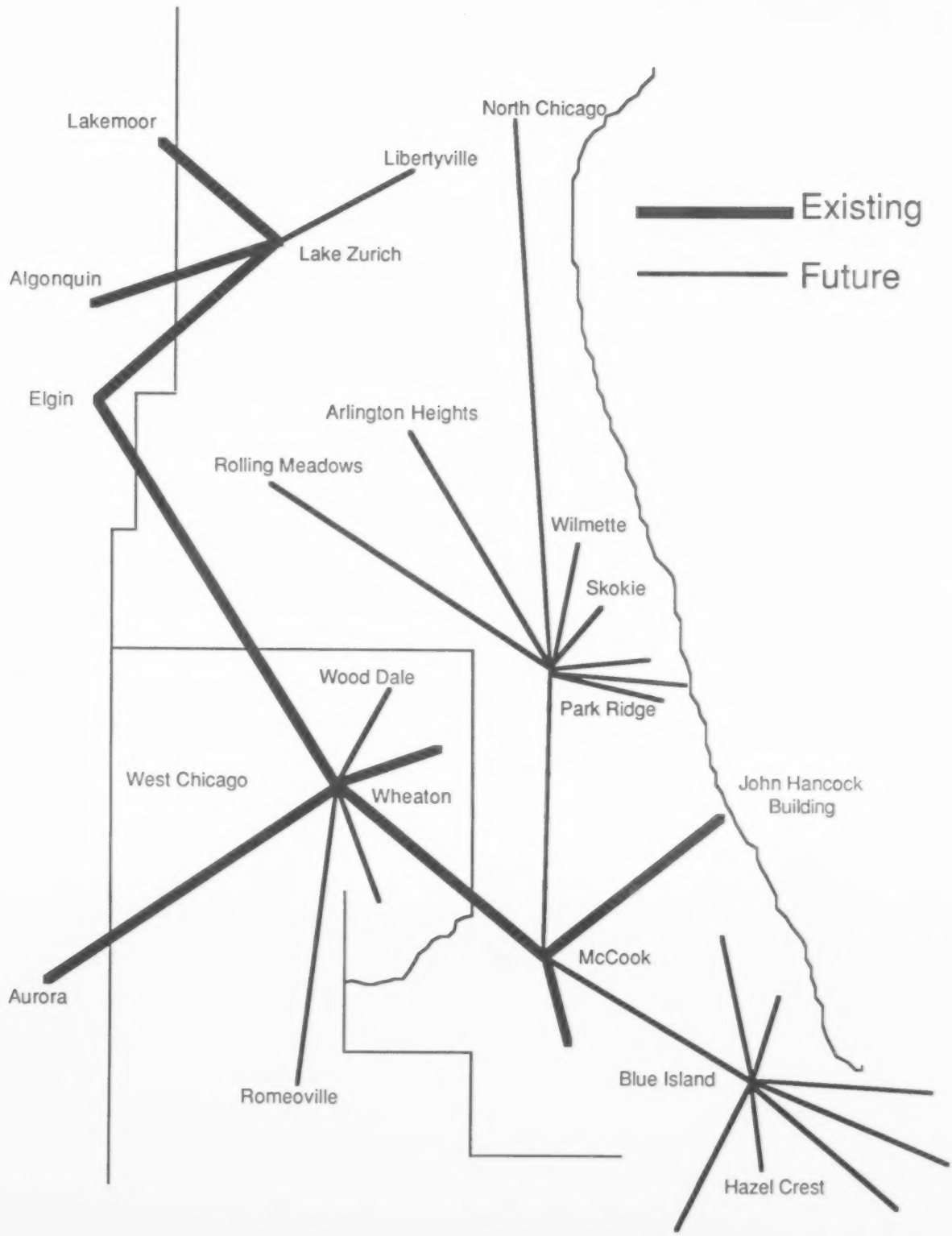
3. Interconnection with the CMS Fiber Network, other common carriers, ITFS, and public television facilities is relatively easy.

Centel Videopath cannot:

1. Provide service beyond the Chicago area.

2. Economically go to locations that are not line of sight to a Videopath node. Multiple microwave hops to reach a certain location raise the price of service considerably. Network extension through cable systems may or may not be viable depending on channel capacity and willingness of the cable operator to lease channels.

# CENTEL VIDEOPATH NETWORK



## APPENDIX F

## PUBLIC/EDUCATIONAL TELEVISION STATIONS

Illinois has eleven public/educational television stations. The map shows the approximate theoretical coverage area of each station.

Coverage of a station is dependent on the transmitter power level, type of antenna, antenna height, and surrounding terrain. Reception at a given location is dependent on antenna height and the intervening terrain between the receiving and station locations.

Statewide coverage is probably more complete than the map indicates. All 18 Library Systems are virtually certain to be included in the coverage area of at least one station. Only a very small percentage of libraries will have difficulty receiving a station. In some cases the station will be delivered via cable television to the library location.

The types of information suitable for transmission on a television station are limited by the uni-directional nature of the system. However, high speed data such as document delivery can be ordered via phone lines and then delivered by the station.

Present regulatory restrictions or lack of authorization for a service by the Federal Communications Commission should not inhibit consideration of various transmission techniques. Some of the potential uses of the broadcast television channel for library applications are not authorized by the FCC because approval has never been requested. The FCC is reasonable and generally eager to expand the application of existing technologies provided present users are not adversely impacted.

Carriage of additional signals on a standard television transmission can be done in two ways. A subcarrier can be inserted on the aural carrier to add audio or low speed data service. The present stereo television system has this capability. Therefore any stereo TV station may be equipped for the additional signals at very little cost.

The second method for adding signals includes using the vertical interval in the standard television signal. Low or medium speed data can be carried in the vertical interval without interference with the regular video and audio transmission. Present uses include closed captioning for the hearing impaired and videotext services. A broadcast data network can be implemented using available hardware. Both of

these techniques can be used during normal program transmission by the station. During the non-operational nighttime hours, the entire video transmission path is available for either video or high speed data transmission.

1. Video can be downloaded and recorded for later playback.

2. Documents can be sent and stored.

Any of the transmitted materials can be addressed and directed to specific homes, businesses, or libraries.

The public/educational television stations may offer a practical solution to the "last mile" problem of information dissemination to widely dispersed end users. On the user end signals are almost universally available throughout the state and equipment is low cost. Cable systems are or can be made transparent to the signal additions to the standard transmission.

Statewide interconnection of stations for utilization of the above techniques may be accomplished through existing video networks. The CMS Fiber Network generally matches the public television station locations and could be used to carry data for insertion on the TV signal.

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## APPENDIX F

### Illinois Public/ETV Stations

1. Carbondale, IL
   WSIU-TV - Channel 8
   Board of Trustees of Southern Illinois U.

2. Charleston, IL
   WEIU-TV - Channel 51
   Eastern Illinois U.

3. Chicago, IL
   WTTW - Channel 11
   Chicago Public Television

4. Chicago, IL
   WYCC - Channel 20
   Board of Trustees of Community College

5. Jacksonville, IL
   WJPT - Channel 14
   West Central IL Educational Telecommunications Corp.

6. Macomb, IL
   WIUM-TV - Channel 22
   West Central IL Educational Telecommunications Corp.

7. Moline, IL
   WQPT-TV - Channel 24
   Black Hawk College

8. Olney, IL
   WUSI-TV - Channel 16
   Board of Trustees of Southern Illinois U.

9. Peoria, IL
   WTVP - Channel 47
   Illinois Valley Public Telecommunications Corp.

10. Quincy, IL
    WQEC - Channel 27
    West Central IL Educational Telecommunications Corp.

11. Urbana-Champaign, IL
    WILL-TV - Channel 12
    University of Illinois

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# ILLINOIS PUBLIC/EDUCATIONAL TELEVISION

## APPENDIX F

### ITFS

Illinois has approximately 18 ITFS stations. Each facility has between one and four channels implemented. ITFS transmission is limited to line of sight. Coverage area of each station is approximately 10-20 miles depending on terrain and antenna heights at the transmitting and receiving locations.

As shown on the map, coverage in the Chicago area is good. Most locations will be within line of sight of one or more ITFS transmitters in the metropolitan area. Coverage throughout the balance of the state is sparse except for the Peoria area.

Conceptually the same types of information can be carried on a ITFS transmission as over standard television broadcast transmitters. This includes subcarrier transmission of audio or low speed data and vertical interval carriage of low or medium speed data. The same types of end user hardware can be used as with broadcast television systems.

Additional ITFS transmitters to provide greater coverage away from the Chicago area could be added. In some cases, channels dedicated to library related transmissions can be added to existing installations. This will provide full time, high speed data transmission for document delivery or other uses.

ITFS systems are basically uni-directional but there are regulatory and technical provisions for a talk-back response transmission back from the receive sites. This feature could be used for the relatively low speed document or service request. Telephone circuits are usually more cost effective for this function, however.

Interconnection of ITFS systems to form a network may be via satellite, microwave, or the CMS Fiber Network. If stations are relatively close, a direct pickup can be made from one transmitter site to the next.

The concept of a network of ITFS stations deserves detailed consideration as a "last mile" delivery mechanism for uni-directional information. Coverage of area businesses, homes, and cable systems is virtually free from a transmission standpoint once the libraries are served. Construction of dedicated stations may be feasible in areas where the density of libraries and other users is sufficient. The limitations are: limited geographic coverage of each station, terrain dependence because of line of sight requirements, and the uni-directional nature of the transmissions.

## APPENDIX F

### Illinois Instructional Television (ITFS)

1. Buffalo Grove - WAH-799
   The Catholic Bishop of Chicago
   Channels F-1-4

2. Chicago - WAC-262
   The Catholic Bishop of Chicago
   Channels C-1-4

3. Chicago - WBM-648
   Illinois Institute of Technology
   Channels E-1-4

4. * Chicago
   Chicago Instructional Technology Foundation Inc.
   Requested Channels D-1 & D-3

5. * Des Plaines - WHR-498
   Board of Trustees, Community College District 535
   Channels B-3-4

6. * Elburn
   National Conference on Citizenship
   Requested Channels G-1-4

7. Northfield - KZB-26
   Board of Education of Twp. High School District No. 203
   Channel H-1

8. Peoria - KTZ-30
   Bradley U
   Channels C-1-4

9. * River Grove - WHM-934
   Triton College
   Channels B-1-4

10. Rock Falls - WHA-62
    Board of Education of Rock Falls Twp. District No. 301
    Channel G-3

11. Sterling - KVI-62
    Board of Education of Sterling Twp. District No. 300
    Channel D-3

12. Sugar Grove
    Waubonsee Community College
    Channels A-1-4

**APPENDIX F**

13. * University Park
Board of Governors State College
Requested Channels B-1-2

14. * Urbana - WHR-606
PBS
Channels A-1-4

15. Westhaven - WAH-801
The Catholic Bishop of Chicago
Channels F-1-4

16. Winnetka - KGZ-66
Board of Education of Twp. High School District No. 203
Channels A-1-4

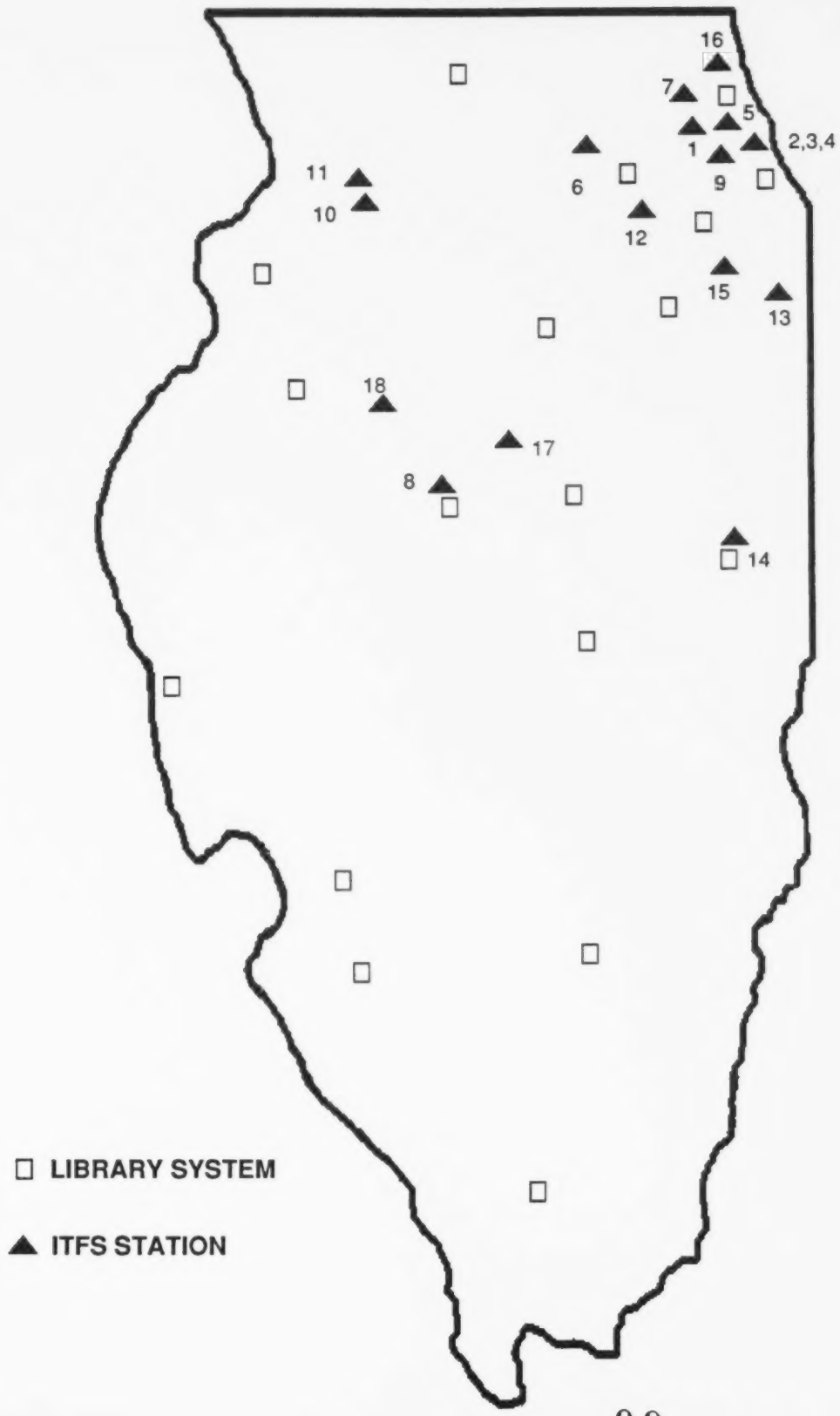
17. Weedford - KVO-30
Bradley U.
Channels E-1-2

18. Wyoming - KVO-29
Bradley U.
Channels A-1-2

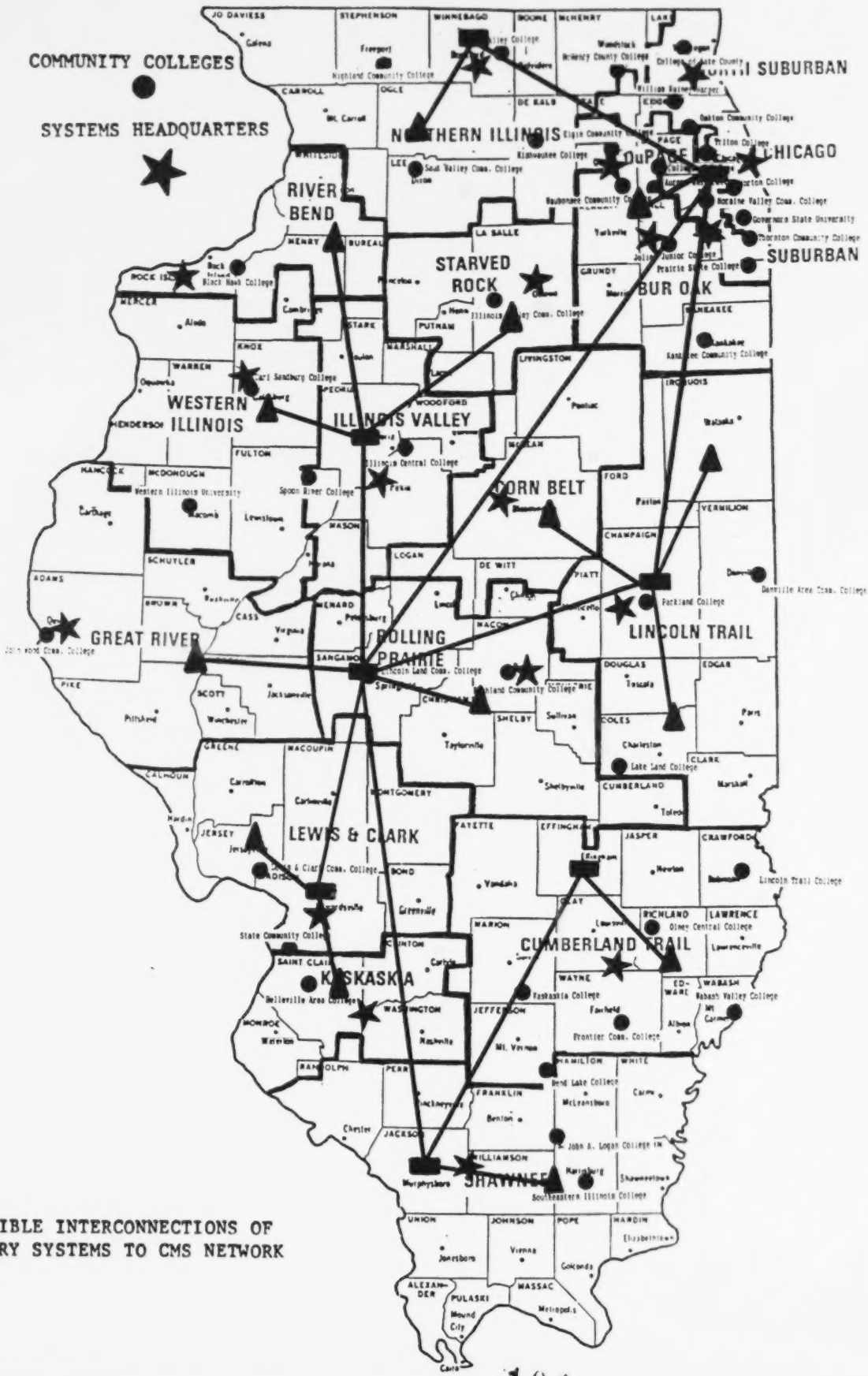
* Indicates an application and or construction permit has been filed, all other listings are licensed.

ITFS61

# ILLINOIS INSTRUCTIONAL TELEVISION ITFS



LIBRARY SYSTEMS




POSSIBLE INTERCONNECTIONS OF
LIBRARY SYSTEMS TO CMS NETWORK

## GLOSSARY

### TELECOMMUNICATIONS TERMS

**Analog:** A signal continuously varied in quantity, such as voltage, to represent variations in another quantity, such as the loudness of a voice or brightness of a picture. The signal is therefore, "analogous" to the information it carries. (See **Digital**)

**Bandwidth:** A measure of the information-carrying capacity of a communications channel; the higher (wider) the bandwidth, the greater the information-carrying capacity. Bandwidth is usually measured in Hertz.

**Baseband:** Refers to a limited bandwidth of frequencies residing on twisted pair or coaxial cable and transporting a single data channel.

**Baud:** A measure of a computer modem's transmission speed, equal to bits per second.

**Belcore:** Bell Company Research. The research arm of the deregulated AT&T.

**BOC:** Bell Operating Company, e.g. Illinois Bell Telephone.

**Broadband:** Refers to a great bandwidth of frequencies, adequate for TV transmission or multiple audio circuits. Fiber optic or coaxial cable in sufficient quantity has broadband capability. A telephone line (twisted pair) does not.

**C-band:** A frequency range, from 4 to 6 gHz (see **Bandwidth** and **Hertz**), used by the first generation of communications satellites.

**CCITT:** Consultative Committee for International Telephone and Telegraph. International standards group sponsored by the United Nations.

**Circuit switching:** Method of communication that establishes an electrical connection between calling and called parties, on demand and for the exclusive use of the parties until the connection is broken.

**Coaxial cable:** Cable made with a center conductor (wire) and a surrounding circular shield; generally capable of greater bandwidth than twisted-pair but less than fiber optic cable.

**CODEC:** Coder-Decoder. A device that converts analog telephone signals to digital format and vice-versa. (See **Analog** and **Digital**)

**Common carrier:** An FCC class of regulated transmission systems, such as telephone, telegraph and certain satellites, which offer services to the public at uniform fees. System owners are divorced from content control. (Broadcast television is not a common carrier)

**CRT:** Cathode Ray Tube. Used for display of television pictures or computer information.

**Database:** An organized collection of files and information stored on disk and available for update and/or retrieval.

**Dedicated:** Characteristic of a machine or system used only for one function; for example, a computer that serves as a "dedicated" word-processing system or an OCLC "dedicated" terminal.

**Digital:** Digital signals, including pictures, sounds or computer data, are represented by a code of "on" and "off" signals. Since digital ignores all but these two signals, it is more precise and less susceptible to interference than analog. (See **Analog**)

**Dish:** Colloquial for "earth station," a saucer-shaped antenna that sends and/or receives satellite transmissions. If it cannot also uplink, the antenna (dish) is a TVRO - television receive only. (See **Uplink** and **Downlink**)

**Distance Learning:** Teaching which uses live audio and sometimes video from a host classroom to distant receiving sites.

**Downlink:** Colloquial for a satellite earth station for receiving satellite signals. Also used as a verb. (See **Uplink**)

**Downloading:** The process of transmitting data, computer software, or even a movie or television program, for recording at the other end of the line. Downloading is often scheduled at the convenience of the sender, but the recording can be played back at the convenience of the recipient.

**Earth station:** The antenna and electronics used to receive signals from a satellite or to transmit signals to a satellite for distribution to other sites on earth.

**Electronic blackboard:** Telephone-based technology which is capable of transmitting hand-drawn graphics between different locations.

**Electronic mail:** Any communication service permitting the electronic transmission and storage of text messages.

**Ethernet:** Baseband protocol and technology developed by Xerox and widely supported by many manufacturers; a packet technology that operates at 10 mbps over coaxial cable and allows terminals, concentrators, workstations, and hosts to communicate with each other.

**Facsimile:** A method of transmitting printed or graphic material over telephone lines.

**FCC:** Federal Communications Commission. A U.S. government office charged with regulating public communications.

**Fiber optics:** Technology concerned with transmitting optical waves over a bundle of fine glass or plastic fibers, thereby permitting the transmission of digitized data around curves and at high speeds without loss.

**Fiber optic backbone:** Cable, composed of optical fibers, laid to form a backbone between nodes which connect to transmission sources and receivers.

**Footprint:** The geographic area in which a given satellite transponder's signal can be received. Different transponders on a satellite often have different footprints.

**Gateway:** A device used to relay data transmission on one network to other networks or to points separate from the network. Functions as a one-stop connection for accessing other telecommunications services.

**Headend:** A cable television system's control center where incoming signals (from satellites and other sources) are put on outgoing channels.

**Hertz:** Cycles Per Second; a measure of electromagnet frequency that represent the number of complete electrical waves in a second: 1 kHz (kilohertz) equals 1,000 Hz; 1 mHz (megahertz) equals 1,000,000 Hz; and 1 gHz (gigahertz) equals 1,000,000,000 Hz.

**Hosts:** Computers, not terminals, that act as data sources or destinations in a communications network.

**Interactive:** Referring to those technologies that permit user participation.

**ISDN:** Integrated Services Digital Network. An international technical framework for digital telephone and data transmission. Originally designed for voice and data, not video.

**ITFS:** Instructional Television Fixed Service. Omni-directional, line-of-sight, microwave TV channels in the ultra-high frequency range, set aside by the FCC for educational use.

**Ku-band:** The range of frequencies, from 11 to 14 gHz, used by the second generation of communications satellites.

**LAN:** Local Area Network. A communications facility covering a limited geographic area (generally measured in buildings or blocks, not miles) and interconnecting communications devices such as terminals and host computers.

**Laser:** Light Amplification by Stimulated Emission of Radiation. A device that emits an extremely narrow beam of light; used in fiber optics.

**Leased Line:** A communications line, from one point to another, leased from the telephone company for the exclusive use of a customer.

**Links:** Communications channels/lines providing paths between nodes.

**Microwave:** Communication (voice, video, data) transmission (point-to-point or omni-directional) requiring line-of-sight transmission between sending and receiving antennas. (See **Point-to-point microwave**)

**Modem:** Modulator-Demodulator. A device that connects terminals and hosts through analog links (e.g. telephone lines) by converting data signals to analog signals and back again.

**Multiplex:** Transmission of two or more information streams over a single physical channel.

**Narrowcasting:** Aiming programming at a specialized or specific audience.

**Network:** Two or more sources/destinations linked via communications channels for the purpose of information exchange or resource sharing.

**Node:** A communication control unit; includes headends, packet switches, hosts, etc.

**Packet:** A collection of data and control characters in a specified format, sent through a network as a single unit.

**Packet Switching:** Communications technique that breaks down messages into smaller units called packets, which are individually addressed and routed through a network. The network link is occupied only during packet transmission.

**PBX:** Private Branch Exchange. A private telephone system serving an individual organization with connections to a public telephone system. A computerized version of the telephone switchboard but with an expanded range of voice and data services and administrative features.

**Point-to-point microwave:** High-frequency signals used to transmit programming (audio, video, data) from one location to another. When both locations use microwave transmission equipment, interactive programming can occur. (See **Microwave**)

**Port:** The connection to a network via a modem, concentrator, or host; usually refers to the ability to plug a cable into a device, such as an 8-port concentrator.

**POTS:** Plain Old Telephone Service.

**Protocol:** A set of procedures implemented in hardware and software to facilitate communications and assure end-to-end data integrity of links, circuits, messages, etc.

**Repeater:** An antenna which receives and retransmits microwave signals, thereby extending the line-of-sight range.

**Routing:** Selecting the minimum delay path in a network for a message or packet to reach it destination.

**Scrambling:** Altering a TV signal transmission so it can't be properly received without a decoder.

**SNA:** Systems Network Architecture. IBM's proprietary advanced communications protocol for the communication language between two or more computers or terminals.

**Switch:** Mechanical or solid-state device that opens or closes circuits, changes operating parameters, or selects paths or circuits on a space or time division basis.

**T-1/D3:** A digital transmission service having a circuit bandwidth of 1.544 mbs which utilizes the North American standard framing format that provides the equivalent of 24 (64 kbs) voice channels.

**Teleconferencing:** Interactive communications among several persons or groups in multiple locations using a variety of telecommunications technologies. The particular technology used further defines the conferencing (e.g. videoconferencing, audioconferencing, computer conferencing)

**Transparent:** Referring to a communications device or network that (1) does not degrade a signal that passes through it, or (2) is extremely unobtrusive and easy to use.

**Transponder:** A satellite component that receives and retransmits a TV signal or sometimes many narrower-band data or audio signals.

**Trunk:** Telephone communication path or channel between two points, one of them usually a telephone company's central office.

**TVRO:** Television Receive Only. A satellite receiving antenna, also known as a downlink.

**Twisted Pair:** A voice or data link consisting of two wires continuously twisted to enhance transmission characteristics. Telephone wire is one type and may consist of many twisted pairs combined to make a larger cable.

**Uplink:** (v.) To transmit to a satellite for relay. (n.) The dish used to transmit.

**Videotext:** An interactive service connecting a TV set and decoder by phone lines or cable TV to a central computer, providing textual information on demand and a variety of transactional services.

**VSAT:** Very Small Aperture Terminal. A small satellite dish for data transmission.

**WAN:** Wide-Area Network. An integrated network spanning a large geographical area, typically used to describe microwave and satellite networks. (See LAN)

**X.25:** An international standard for control of data communications between two or more computers or terminals using packet-switching technology.